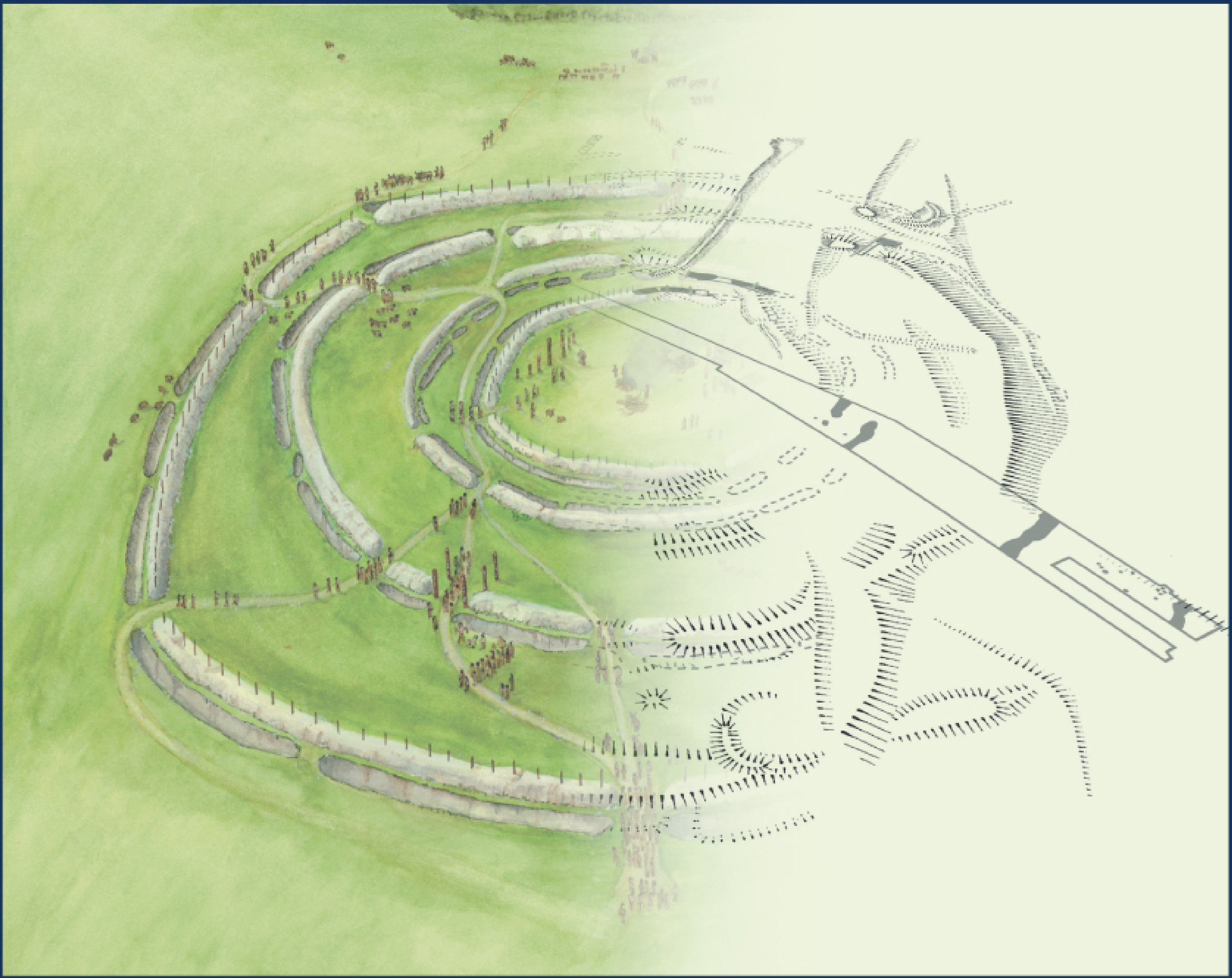
Gathering Time

Dating the Early Neolithic Enclosures of Southern Britain and Ireland



Alasdair Whittle, Frances Healy and Alex Bayliss

Volume 1

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Contents

VOLUME I

Authors' note

This book is about the dating of the early Neolithic causewayed enclosures of southern Britain and Ireland. Currently it is also, by far, the largest application of the Bayesian approach to modelling archaeological chronologies undertaken anywhere in the world. As such, we hope that this study will be of wider interest, not only for specialists in the European Neolithic, but for archaeologists everywhere so far lacking precise dating. The effort of this project could have been directed, after all, at any number of other kinds of site, period or area.

Different readers may wish to trace different paths through this volume. Chapter 1 provides an overview of the questions which the project aims to address, and sets the scene for those readers who are not devoted to the early Neolithic of Britain and Ireland. Bayesian virgins – a term which currently includes the vast majority of archaeologists inhabiting planet earth! – should read Chapter 2, which provides an introduction to the methods employed in the following chapters. Chapters 3–11 each deal with the enclosures of a southern British region and place them in the context of the regional evidence for other early Neolithic activity. Chapter 12 similarly covers Ireland, but on an island-wide basis. These regional chapters can be digested piecemeal, but we strongly urge all readers to engage with at least one of them (3, 7, or 10 may be the most digestible) before attempting to grapple with the more synthetic discussions contained in Chapters 12 and 14.

These chapters weave narratives out of the chronological threads spun from the models constructed in the course of the regional discussions. They therefore contain many complex models, which often build on the foundations laid in the site-based and regional models and represent a second level of interpretation. The implications of these narratives, both for our understanding of the early Neolithic of southern Britain and Ireland, and the ways in which we can now practise prehistory, are discussed in Chapter 15.

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The project owes its execution and completion to its co-funders, the Arts and Humanities Research Council and English Heritage. We are wholeheartedly grateful to them for the opportunity to undertake the work reported here. English Heritage also monitored the project's progress, providing a store of support and advice. Here we owe a particular debt to Jonathan Last, Head of Research Policy for Prehistory and to Andrew David, Head of Archaeological Science and Archaeological Archives, as well as to Barney Sloane and Chris Scull. Grateful thanks are also due to John Meadows, Derek Hamilton, Henrietta Granlund Marsden, Isabelle Parsons and Kate Cullen of the Scientific Dating Section. The Arts and Humanities Research Council also supported the Thames Valley project (see Chapter 13).

Radiocarbon dates were the cornerstone of the project. The AMS dates obtained in the course of the project were measured by the Oxford Radiocarbon Accelerator Unit, led by Christopher Bronk Ramsey, and by the Centrum voor IsotopenOnderzoek, Rijksuniversiteit Groningen, led by Johannes van der Plicht. A smaller number of high precision measurements were made by the Queen's University, Belfast Radiocarbon Dating Laboratory, led by Gerry McCormac. All three laboratories were immensely professional and helpful, consistently delivering results on time so that work could proceed, answering numerous questions and making extra measurements to resolve specific problems.

Equally essential was access to collections and permission to sample them. We owe an immense debt to Museum curators, among them: Janet Ambers, Gillian Varndell and Pam Young of the British Museum; Tom Cadbury of the Royal Albert Memorial Museum and Art Gallery, Exeter; Jonathan Catton of Thurrock Local History Museum; Rosamund Cleal of the Alexander Keiller Museum, Avebury; Ian Friel of Chichester District Museum; Jill Greenaway of Reading Museum Service; Paul Hyman of Wardown Park Museum, Luton; Richard Le Saux of Brighton Museum and Art Gallery; Arthur MacGregor and Alison Roberts of the Ashmolean Museum, Oxford; Jane Marley of the Royal Cornwall Museum, Truro; Emma O'Connor of Barbican House Museum, Lewes; Oxfordshire Museum Services; Paul Robinson of the Wiltshire Heritage Museum, Devizes; Sara Rodger of the Arundel Castle archives; Richard Sabin of the Natural History Museum; Peter Saunders of the Salisbury and South Wiltshire Museum; the staff of the Towner Art Gallery and Local History Museum, Eastbourne; and Peter Woodward of the Dorset County Museum, Dorchester.

The volume could not have been written without the co-authors of individual chapters, who provided a fund of specialised knowledge and advice, access to potential samples from excavations still under analysis, illustrations and their own valuable time. Numerous other colleagues generously gave support, information and advice, among them Luke Barber, Sussex Archaeological Society (formerly of Archaeology South-East); Martyn Barber, English Heritage; Alistair Barclay, Wessex Archaeology; Martin Bell, University of Reading; Robin Bendrey, University of Winchester; Anna Brindley, Rijksuniversiteit Groningen; Steve Burrow, National Museum, Cardiff; Peter Drewett, University of Sussex; Toby Driver, Royal Commission on the Ancient and Historical Monuments of Wales; Tim Gent, Exeter Archaeology; Frances Griffith, Devon County Council; Detlef Gronenborn, Römisch-Germanisches Zentralmuseum, Mainz; Chris Hayden, Oxford Archaeology; Neil Holbrook, Cotswold Archaeological Trust; Mike Ilett, University of Paris; Lars Larsson, Lund University; Ken Murphy, Cambria Archaeology; Poul Otto Nielsen, National Museum, Copenhagen; Jacqueline Nowakowski, Cornwall County Council; Joshua Pollard, University of Southampton; Miles Russell, Bournemouth University; Jean-Luc Schwenninger, Oxford University Research Laboratory for Archaeology and the History of Art; Alison Sheridan, National Museum of Scotland; Martin Smith, University of Birmingham; Julian Thomas, University of Manchester; Martin Tingle; and Lesley Zienkiewicz. Wessex Archaeology shared information about the excavation of the Kingsborough and Northborough enclosures prior to publication, and we thank Tony Lynch for permission to quote unpublished isotopic data.

Any volume which seeks to synthesise a large corpus of existing radiocarbon dates, many of which were measured many years ago, throws up innumerable queries. All the radiocarbon dating laboratories we approached for further information in this regard were unfailing helpful, and we thank for providing such details: Janet Ambers, British Museum; Gordon Cook, SUERC Radiocarbon Dating Laboratory; Henny Deenen, Rijksuniversiteit Groningen, The Netherlands; Darden Hood, Beta Analytic Inc., USA; Stephen Hoper and Michelle Thompson, Belfast Radiocarbon Laboratory; John Matthews, University of Swansea; Marie-Josée Nadeau, Christian-Albrechts Universität zu Kiel, Germany; Ingrid Olsson, University of Stockholm; Anna Pazdur, Silesian University of Technology, Poland; Fiona Petchey, Waikato Radiocarbon Laboratory, New Zealand; and Michael Sim, Rafter Radiocarbon Laboratory, New Zealand.

In Cardiff University, Ian Dennis succeeded in the daunting task of creating many of the illustrations and of preparing the heterogeneous and often intractable remainder for publication. Kirsty Harding helped to push things over the line. Dani Hofmann, Emily Stewart and Sue Virgo did

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On a final personal note, Alex would like to thank Lynne Keys for putting up with her being in Cardiff for so much of the past decade, and Alasdair would like to thank Anna and Andrew Maxwell for unstinting hospitality in London.

The archive

The paper archive consists of copies of submission forms and certificates of results for radiocarbon samples, with some accompanying correspondence. The digital archive consists of a database of both dated samples and potential samples from enclosures, with contextual, bibliographic and other information. It will be integrated with the radiocarbon dating archive and database of the Scientific Dating Section of English Heritage (National Monuments Record Centre, Kemble Drive, Swindon, SN2 2GZ).

Summary

This volume presents the results of a dating programme on the early Neolithic causewayed enclosures of southern Britain and Ireland. By incorporating hundreds of radiocarbon dates from nearly 40 southern British causewayed enclosures in Bayesian chronological models, in the largest exercise of this kind so far undertaken, it is estimated that the main period of enclosure construction lasted from the late 38th century cal BC until the mid-to-late 36th century cal BC. While some sites were in primary use for up to three centuries, many others proved to be of much shorter duration (even down to a few decades). By comparing results from enclosures with other aspects of the early Neolithic in southern Britain, creating Bayesian chronological models incorporating hundreds of radiocarbon dates from other monuments including long barrows and from settlement sites, it is shown that enclosures appeared up to 300 years after the first Neolithic things and practices were established in southern Britain, from the 41st century cal BC. The process of the spread of the Neolithic in Britain is shown to have been gradual and regionalised, taking over two centuries and beginning in south-east England. The first long barrows and related monuments are shown to precede causewayed enclosures by a century or so. Tens of radiocarbon dates from two enclosure sites in Ireland were also modelled in a Bayesian framework, and put into context by comparison with hundreds of radiocarbon dates from other aspects of the early Neolithic in the island. Although one of these enclosures presents particular difficulties of interpretation, it is argued that the early Neolithic in Ireland probably began around 3800 cal BC.

Chapter 1 introduces central questions of time and chronological resolution, arguing that many archaeologists have been resigned to imprecise timescales, which affects the kind of pasts they regularly construct. It goes on to introduce causewayed enclosures and the history of their research. Chapter 2 introduces the main concepts of Bayesian chronological modelling and describes the detailed information and rigorous interpretations which are required for its successful implementation in archaeological practice. Not only is the vital 'prior' archaeological information – knowledge of sample taphonomy, context, association and stratigraphy – discussed, but also the statistical assumptions involved in model building. We emphasise the inevitable scatter of radiocarbon dates for any given phenomenon which, unless models are constructed to counteract this, means that any given phenomenon will normally appear to have begun earlier, lasted longer and ended later than was the case in reality. The laboratory procedures necessary for accurate radiocarbon dating and an assessment of the accuracy of the existing corpus of radiocarbon dates are also discussed.

In this project, southern Britain has been divided into a series of pragmatically defined regions (Chapters 3–11). In each chapter, chronological models for the causewayed enclosures chosen for study are presented first, with consideration of the implications of the new chronologies for our understanding of each site. It is estimated that enclosures were constructed from the late 38th century cal BC until the mid-to-late 36th century cal BC. Many sites were in primary use for relatively restricted periods of time, although some remained in use for 300 years or so. The following enclosures were dated in the course of the project: Windmill Hill and Knap Hill, in north Wiltshire (Chapter 3, with consideration of Rybury); Whitesheet Hill, Maiden Castle and Robin Hood's Ball, in south Wessex (Chapter 4, with re-analysis of the extensive series of radiocarbon dates from Hambledon Hill); Whitehawk, Offham Hill, Bury Hill, The Trundle and Court Hill, in Sussex (Chapter 5, with consideration of Barkhale, Combe Hill and Halnaker Hill); Maiden Bower, Haddenham, Etton, Etton Woodgate and Northborough, in eastern England (Chapter 6, with consideration of Briar Hill and Great Wilbraham); Orsett, Kingsborough 1 and 2, and Chalk Hill, in the Greater Thames estuary (Chapter 7, with re-analysis of the existing radiocarbon dates from St Osyth); Staines, Eton Wick, Gatehampton Farm and Abingdon, in the middle and upper Thames valley (Chapter 8); Crickley Hill and Peak Camp, in the Cotswolds (Chapter 9); Hembury and Raddon Hill, and the stone-walled tor enclosures of Helman Tor and Carn Brea, in the south-west peninsula (Chapter 10, with consideration of Membury); and Hill Croft Field and Banc Du in south Wales and the Marches (Chapter 11, with dating of Beech Court Farm, which proved to be of much later date, and of Billown on the Isle of Man, an important early Neolithic settlement but probably not a causewayed enclosure in the southern British sense). Radiocarbon dates and chronological models for other early Neolithic activity in the region are then presented. Formal estimates for the appearance of Neolithic things and practices are presented in Chapters 5, 6, 9, 10 and 11, with further analysis presented in Chapter 14. Each chapter concludes with a discussion of the implications of all the chronologies in the region for understanding the first centuries of Neolithic activity there.

In Ireland (Chapter 12), chronological models are presented for the enclosures of Donegore and Magheraboy. The construction of Donegore, Co. Antrim, falls within the main *floruit* of southern British enclosure building, and its local and regional contexts are considered. Magheraboy, Co. Sligo, appears to date rather earlier, to the 40th or 39th centuries cal BC. This necessitated a wider review of the dating of the early Neolithic in Ireland as a whole.

Hundreds of radiocarbon dates have been incorporated into chronological models for a range of other monuments and activity, and it is estimated that Neolithic things and practices first appeared in the island in the late 39th or 38th centuries cal BC (two main variant models are given). There is much that is not precisely dated, including many court tombs and portal tombs; Linkardstown burials and passage tombs are seen as middle Neolithic innovations, of the second half of the fourth millennium cal BC, and are used to constrain the models for the early Neolithic. Rectangular timber houses are better dated, and were constructed and used only from the late 38th into the 37th century cal BC. Domesticated cattle aside, which are present in a later fifth millennium context at Ferriter's Cove, Co. Kerry, there is a challenging gap between the apparent early dating of Magheraboy and the onset of Neolithic things and practices in Ireland as estimated by all the other chronological models. Further discussion of Ireland in the context of southern Britain follows in Chapter 14.

A suite of isotopic data from human and animal samples from four southern British causewayed enclosures are given in Chapter 13. Comparing results with other early Neolithic contexts, probable diversity in environments and diets is emphasised.

Chapter 14 pulls together the chronological threads spun in Chapters 3–12 to construct narratives for the development of the early Neolithic in southern Britain and in Ireland. Causewayed enclosures in southern Britain are analysed first; then other early Neolithic activity, including models for the appearance of Neolithic things and practices across southern Britain. Finally, the appearance of the Neolithic in Ireland, the Isle of Man and Scotland south of the Great Glen is considered.

Many central aspects of southern British causewayed enclosures are examined from the perspective of the more precise chronologies now available. The currency, the establishment and the spread of causewayed enclosures are analysed, the individual site and regional models being brought together. The first enclosures appeared in eastern parts of the country, and the pace of construction accelerated over three to four generations to a peak in the later 37th century cal BC, apparently followed by a lull at the turn of the 36th century and then resumption of fresh building till the mid- to late 36th century cal BC. Modelling also enables more precise discussion of the effort of construction, which at some sites now can be broken down into more concentrated episodes of labour investment; of the trajectories of development of multiple circuits and multiple enclosures, which may have a tendency to last longer than simpler layouts; and of the endings and very variable durations of enclosures. Modelled estimates for rates of ditch filling and recutting are presented, and, at a selection of sites, for the intensity of deposition in enclosure ditches; more precise timescales serve to show less intensive deposition at any one time than often supposed in the literature, but nonetheless it is clear that substantial numbers of people could have been fed by the meat from even one or two cattle. A series of dated episodes of violence at enclosures, including killings, attacks by archery and burnings, are compared, with fewer signs of this behaviour in the eastern part of southern Britain.

Apart perhaps from two or three early candidates, it appears that constructions such as long barrows and long cairns began to be built in numbers probably from around 3800 cal BC. There is so far no support for claims that forms such as portal dolmens, small oval barrows or rotundae are particularly early. In each region studied in southern Britain, the appearance of causewayed enclosures can be shown to be later than the start of other early Neolithic activity. The interval varies, because the date estimates for the start of other Neolithic activity vary by region across southern Britain. The first Neolithic things and practices appear in the Greater Thames estuary in the 41st century cal BC, spreading westwards, although not necessarily from a single focus, to emerge in south Wales and the Marches by the generations around 3700 cal BC. Chronological trends in the development of pottery styles and axe production and circulation can also be modelled. South-Western pottery appears in the 38th century cal BC, later than the ubiquitous Carinated Bowl style which is present from the beginning, and Decorated pottery in the late 38th or early 37th century cal BC, either coinciding with or just after the emergence of enclosures. Axehead circulation also appears to have extended from the 38th into the 37th century cal BC. Such developments help to define an accelerating surge of innovations through the 38th century cal BC, preceding and accompanying the emergence of enclosures themselves. This section of Chapter 14 ends with a synthetic narrative of the main elements of the development of the early Neolithic in southern Britain as a whole.

Chapter 14 continues with comparison of the early Neolithic sequences in Ireland (drawing on Chapter 12), on the Isle of Man (from Chapter 11) and in Scotland (using available radiocarbon dates for the area south of the Great Glen). The modelled date estimates suggest that the start of early Neolithic activity in Ireland and Scotland fell in the late 39th or earliest 38th century cal BC, and on the Isle of Man perhaps in the 38th century cal BC. Timber halls in Scotland are identified as early features of Neolithic activity; other monument sequences are harder to trace in both countries (and there are virtually no dates for the monuments of the Isle of Man). Chapter 14 concludes with a review of the chronological development of the early Neolithic in Britain and Ireland as a whole.

Chapter 15 offers commentary on the narratives laid out in Chapter 14. Here, the discussion tracks the sequence, from the start until the latter part of the early Neolithic. The models set out in Chapter 14 for the start of early Neolithic activity are compared with other dominant interpretations in the literature, from colonisation on the one hand to indigenous acculturation on the other. A different interpretation is adopted, using wider colonisation theory, in which there was probably some, small-scale colonisation from the adjacent continent, into southern England, followed by a continuing, and accelerating spread of Neolithic things and practices, which probably

involved indigenous acculturation from early on. Patterns of settlement and change are briefly examined on the adjacent continent, in order to reinforce the probability of small-scale, filtered colonisation, combined with local change. Evidence for settlement and subsistence in the first centuries of the southern British Neolithic is then reviewed in the light of the chronological models. It is argued that there are no clear signs of either radical increases in population or marked intensification of economic practices, though much remains to be better understood, including the development of cattle herding. Monuments and material culture, however, show more signs of change. The possible social roles of constructions such as long barrows and long cairns, which began to be built in numbers probably from around 3800 cal BC, are considered, including involvement in the competitive definition of group identities. The accelerating surge of material innovations through the 38th century cal BC, preceding and accompanying the emergence of enclosures themselves, also helps to suggest dynamic social conditions, perhaps competitive.

The continental background of enclosure construction and use shows a long history, back to the sixth millennium cal BC. Causewayed enclosures in southern Britain and in Ireland can be best compared with those of the Michelsberg-Chasséen complex on the adjacent continent, said to have appeared already in the later fifth millennium but to have still been built in the earlier fourth millennium cal BC (although the imprecision of the available Continental chronologies makes the unravelling of fine-grained connections currently impossible). The establishment of enclosures in southern Britain from around 3700 cal BC speaks for (apart from the possibility of the arrival of new people) a deliberate attempt to evoke contacts and affiliation with more distant practices, and reinforces the notion of inter-group competition and emulation.

Worldviews centred in a combination of ideas, including principles of seniority, prowess and affiliation or connection, are given a specific context by the detailed history of enclosure building and use in the *floruit* of their construction in the 37th and 36th centuries cal BC. Differing characterisations of social relations are considered for this context, with special attention given to the possible role of pre-eminent ritual experts and organisers. The southern British emphasis on enclosures at this time is contrasted with other kinds of sociality elsewhere in Britain and Ireland, perhaps smaller-scale and less intense, as seen for example in the building of timber halls and houses, and various forms of barrows and cairns; there are, however, overlaps, as in the circulation of axeheads through some house sites in Ireland, and a widespread regard for forebears and other dimensions of the past.

From the later 36th into the 35th and 34th centuries cal BC, there appears to have been a complex world of innovation and continuity. While the primary use of some causewayed enclosures continued, and there may have been a few late constructions, after a *floruit* of only eight generations or so, monumental innovation passed to the building of linear cursus monuments. Long barrows and long cairns, and probably also portal dolmens, continued to be constructed and used. In the present state of evidence, with many features beyond the immediate remit of the project, it is hard to characterise this situation, but explanations could include either an increase in inter-group competition or something more subtle by way of rivalry between senior and junior clans or lineages.

The volume ends with further reflection on kinds of time, agency and memory. The much more precise timescales for some aspects of the early Neolithic in southern Britain enable emphasis to be shifted from the *longue durée* to a social history measurable at the scale of centuries, half centuries, generations and even on occasion decades. This opens up various kinds of transmission between generations to much closer interpretation, and beams a light into ‘prehistory’.

Résumé

Ce volume présente les résultats issus d'un programme de datation qui concerne les enceintes à fossés interrompus dans le sud de la Grande Bretagne et en Irlande. Des centaines de datations radiocarbones, provenant d'une quarantaine d'enceintes à fossés interrompus du sud de la Grande Bretagne, ont été intégrées dans des modèles chronologiques bayésiens – un exercice d'une très grande amplitude, jamais réalisé auparavant. Il a été démontré que la période de construction principale des enceintes s'étend de la fin du 38ième siècle jusqu'au milieu voire la fin du 36ième siècle cal BC. En outre, si la période d'utilisation principale peut atteindre jusqu'à trois siècles sur certains sites, elle s'avère être bien plus courte dans beaucoup d'autres cas (parfois à peine quelques décennies). Les résultats obtenus pour les enceintes ont été comparés à ceux issus d'autres contextes du Néolithique ancien dans le sud de la Grande Bretagne. Pour ces derniers, des modèles chronologiques bayésiens ont également été élaborés, intégrant des centaines de dates radiocarbones regroupant aussi bien des sites d'habitat que des monuments tels des tumulus allongés (*long barrows*). Ainsi, il a pu être démontré que les enceintes sont apparues jusqu'à trois cents ans après l'introduction des premiers objets et pratiques néolithiques dans le sud de la Grande Bretagne, à partir du 41ième siècle cal BC. Le processus de diffusion du Néolithique en Grande Bretagne est progressif et régional, il s'étale sur deux siècles et prend sa source dans le sud-est de l'Angleterre. Il a été mis en évidence que les premiers tumulus allongés (*long barrows*) et monuments apparentés précèdent d'environ un siècle les enceintes à fossés interrompus. Quelques dizaines de datations radiocarbones provenant de deux enceintes en Irlande ont également été modélisées dans une approche bayésienne, placées dans leur contexte et comparées avec des centaines de datations radiocarbones provenant d'autres contextes Néolithique ancien de l'île. Bien qu'une de ces enceintes soit particulièrement sujette à des problèmes d'interprétation, on peut maintenir que le Néolithique ancien en Irlande débute probablement autour de 3800 cal BC.

Le chapitre 1 introduit les principales questions ayant trait à la chronologie et à la résolution chronologique, sachant que de nombreux archéologues se sont résignés à des chronologies imprécises ce qui a une incidence sur les scenarios du passé qu'ils ont l'habitude de construire. En second plan seront présentées les enceintes à fossés interrompus et l'historique de leurs recherches. Le chapitre 2 expose les concepts principaux de la modélisation chronologique bayésienne et met l'accent sur l'information détaillée et l'interprétation rigoureuse requises pour une application réussie en archéologie. Seront discutés, non seulement les données archéologiques essentielles de départ – connaissance de la taphonomie des échantillons, du contexte, des associations et de la stratigraphie – mais également les hypothèses statistiques impliquées dans l'élaboration des modèles. En outre, l'accent est mis sur l'inévitable dispersion des datations radiocarbones pour chaque évènement donné – puisque les modèles sont élaborés pour contrebalancer ce phénomène – à savoir, chaque évènement donné semble avoir un début plus précoce, une durée plus longue et une fin plus tardive qu'il y paraîtrait dans la réalité. Les procédures techniques nécessaires à une datation radiocarbone précise seront également discutées ainsi que l'évaluation de la précision du corpus des datations radiométriques existantes.

Dans le cadre de ce projet, le sud de la Grande Bretagne a été subdivisé en une série de régions définies arbitrairement (chapitres 3 à 11). Les modèles chronologiques sont présentés au début de chaque chapitre et tiennent compte des implications apportées par les nouvelles chronologies dans la compréhension de chaque site. La durée estimée des constructions d'enceintes s'étend de la fin du 38ième siècle jusqu'au milieu voire la fin du 36ième siècle cal BC. Dans la plupart des sites, la période d'occupation principale est relativement courte même si chez certains elle atteint trois cents ans environ. Les enceintes suivantes ont été datées au cours du projet: Windmill Hill et Knap Hill dans le nord du Wiltshire (chapitre 3, en tenant compte de Rybury); Whitesheet Hill, Maiden Castle et Robin Hood's Ball, dans le sud du Wessex (chapitre 4, avec une nouvelle analyse de l'importante série de datations radiocarbones provenant de Hambledon Hill); Whitehawk, Offham Hill, Bury Hill, The Trundle et Court Hill, dans le Sussex (chapitre 5, en tenant compte de Barkhale, de Combe Hill et de Halnaker Hill); Maiden Bower, Haddenham, Etton, Etton Woodgate et Northborough, dans l'est de l'Angleterre (chapitre 6, en tenant compte de Briar Hill et de Great Wilbraham); Orsett, Kingsborough 1 et 2, et Chalk Hill, dans l'estuaire de la Tamise (chapitre 7, avec une révision des dates radiocarbones existantes du site de St Osyth); Staines, Eton Wick, Gatehampton Farm et Abingdon, dans la moyenne et haute vallée de la Tamise (chapitre 8); Crickley Hill et Peak Camp, dans les Cotswolds (chapitre 9); Hembury et Raddon Hill, ainsi que les enceintes de type tor, délimités par des murs en pierres sèches de Helman Tor et Carn Brea, dans le sud-ouest de la péninsule (chapitre 10, en tenant compte de Membury); et finalement Hill Croft Field et Banc Du dans le sud du Pays de Galles et dans les Marches (chapitre 11, la datation de Beech Court Farm, s'est révélée être beaucoup plus tardive, tout comme celle de Billown sur l'île de Man, un habitat important du Néolithique ancien mais probablement pas une enceinte à fossés interrompus à l'image de celles du sud de la

Grande Bretagne). Par la suite, sont présentés les datations radiocarbones et les modèles chronologiques élaborés pour d'autres contextes du Néolithique ancien dans la région. Des estimations globales concernant l'apparition des objets et pratiques néolithiques sont données dans les chapitres 5, 6, 9, 10 et 11, avec une analyse supplémentaire exposée dans le chapitre 14. Chaque chapitre se termine avec la discussion des implications de l'ensemble des chronologies afin d'améliorer la compréhension des premiers siècles de l'occupation néolithique dans ces régions.

Concernant l'Irlande (chapitre 12), des modèles chronologiques ont été élaborés pour les enceintes de Donegore et de Magheraboy. La construction de Donegore, dans le comté d'Antrim, coïncide avec la période principale de construction des enceintes dans le sud de la Grande Bretagne. Cependant, le contexte local et régional de ce site est discuté. Magheraboy, dans le comté de Sligo, semble être plus précoce, du 40ième ou 39ième siècle cal BC. Cette observation a nécessité une révision plus large de la datation de l'ensemble du Néolithique ancien en Irlande. Des centaines de datations provenant d'une série de différents monuments et faits, intégrées dans des modèles chronologiques, permettent de supposer que les premiers objets et pratiques néolithiques apparaissent sur l'île à la fin du 39ième ou pendant le 38ième siècle cal BC (deux variantes principales du modèle sont proposées). Beaucoup de monuments ne sont pas datés avec précision, de même qu'un grand nombre de tombes à cour et de dolmens. En revanche, la datation des cistes de type Linkardstown et des tombes à couloir, considérées comme innovations du Néolithique moyen, dans la deuxième moitié du quatrième millénaire cal BC, est l'argument principal pour délimiter les modèles développés pour le Néolithique ancien. Les maisons à poteaux et à plan rectangulaire sont datées avec plus de précision. Elles ont été construites et occupées exclusivement de la fin du 38ième jusqu'au 37ième cal BC. A l'exception du bœuf domestique, qui est attesté dans un contexte daté de la fin du cinquième millénaire à Ferriter's Cove, dans le comté de Kerry, se pose le problème du hiatus entre la date apparemment précoce de Magheraboy et celle de l'apparition des objets et pratiques néolithiques en Irlande, soutenue dans tous les autres modèles chronologiques. Une discussion plus approfondie du contexte irlandais par rapport à celui du sud de la Grande Bretagne suit dans le chapitre 14.

Le chapitre 13 présente une série de datations isotopiques obtenues sur des ossements humains et animaux prélevés dans quatre enceintes à fossés interrompus dans le sud de la Grande Bretagne. La comparaison des résultats avec d'autres contextes du Néolithique ancien, met l'accent sur une diversification probable des environnements et des diètes.

Le chapitre 14 réunit les séries individuelles présentées dans les chapitres 3 à 12 qui serviront à construire des scenarios évolutifs du Néolithique ancien dans le sud de la Grande Bretagne et en Irlande. En premier lieu seront analysées les enceintes à fossés interrompus du sud de la Grande Bretagne, ensuite l'analyse portera sur les autres contextes du Néolithique ancien y compris les modèles développés autour de l'apparition des objets et pratiques néolithiques dans tout le sud de la Grande Bretagne. Enfin sera discutée l'apparition du Néolithique en Irlande, ainsi que sur l'Ile de Man et en Ecosse, au sud du Great Glen.

De nombreux aspects déterminants, caractérisant les enceintes à fossés interrompus du sud de la Grande Bretagne, sont examinés à partir des chronologies plus précises maintenant disponibles. La fréquence, la fondation et la diffusion des enceintes à fossés interrompus sont analysées et les modèles développés pour chaque site sont individuellement rapprochés du modèle régional. Les premières enceintes émergent dans les régions à l'est du pays et le rythme des constructions s'accélère pendant trois ou quatre générations avant de culminer vers la fin du 37ième siècle cal BC. Il s'en suivra apparemment un ralentissement au tournant du 36ième siècle cal BC et une reprise de nouvelles constructions jusqu'au milieu voire la fin du 36ième siècle cal BC. La modélisation permet également d'élaborer une analyse plus fine des efforts de construction. Ceux-ci, dans quelques sites peuvent être segmentés en épisodes concentrés d'investissement en travail; en trajectoires de développement de circuits multiples et en construction d'enclos multiples. Ces constructions ont tendance à perdurer plus longtemps que des formes de construction plus simples, ou même plus longtemps que les enceintes dont les fins et les durées sont très variables. Pour un petit nombre de sites, des estimations modélisées concernant le rythme de remplissage des fossés et les recoupements sont présentés ainsi que le volume des dépôts dans les fossés des enceintes. Des chronologies plus précises ont permis de mettre en évidence l'existence de dépôts moins importants dans chaque évènement isolé par rapport à ce qui a été supposé dans la littérature. Il ressort de façon évidente que la viande d'une ou de deux vaches suffisait sans doute à nourrir un grand nombre de personnes. Dans les enceintes ont été datées des séries d'épisodes violents incluant des tueries, des attaques d'archers et des incendies. Ces comportements sont par comparaison moins fréquents dans la partie est du sud de la Grande Bretagne.

Excepté peut-être deux ou trois monuments, il semble que des constructions de type tumulus allongés (*long barrows*) et les cairns allongés (*long cairns*) ont été érigés en plus grand nombre à partir de 3800 cal BC environ. Jusqu'à présent, rien ne permet de soutenir l'hypothèse que des architectures comme les dolmens à portique et les petits tumulus ovalaires ou circulaires remontent à une date particulièrement précoce. Dans chaque région étudiée du sud de la Grande Bretagne, il peut être mis en évidence que l'apparition des enceintes à fossés interrompus succède à l'établissement des autres occupations du Néolithique ancien. Cet intervalle varie dans la mesure où les datations estimées, qui situent le début des autres contextes du Néolithique ancien, varient dans les différentes régions d'un bout à l'autre du sud de la Grande Bretagne. Les premiers objets et pratiques sont introduits dans l'estuaire de la Tamise au cours du 41ième siècle cal BC puis se

diffusent vers l'ouest – pas forcément depuis un seul centre d'origine – et émergent dans le sud du Pays de Galles et dans les Marches autour de 3700 cal BC. L'évolution chronologique des styles céramiques et de la fabrication et de la circulation des haches peut également être modélisée. La céramique du sud-ouest apparaît au 38ième siècle cal BC, plus tard que le style à bols carénés omniprésent qui est attesté dès le début du Néolithique et plus tard également que la céramique décorée de la fin du 38ième siècle ou du début du 37ième siècle cal BC, soit en même temps ou juste après l'émergence des enceintes.

De la même manière, la circulation des lames de hache semble s'étendre du 38ième siècle jusqu'au 37ième siècle cal BC. De telles trajectoires permettent de définir une montée des innovations tout au long du 38ième siècle cal BC, qui précèdent et accompagnent l'émergence des enceintes elles-mêmes. Cette partie du chapitre 14 se termine avec un scénario de synthèse des principaux éléments qui constituent le Néolithique ancien du sud de la Grande Bretagne dans sa globalité.

Le chapitre 14 se poursuit en comparant des séquences du Néolithique ancien en Irlande (en référence au chapitre 12), sur l'île de Man (chapitre 11) et en Ecosse (en utilisant les datations disponibles pour l'aire géographique au sud du Great Glen). Les estimations modélisées des datations laissent supposer un début du Néolithique en Irlande et en Ecosse qui coïncide avec la fin du 39ième ou le tout début du 38ième siècle cal BC. Sur l'île de Man, celui-ci se situe probablement au courant du 38ième siècle. En Ecosse, les édifices en bois sont identifiés comme des structures associées à une occupation néolithique précoce. Dans ces deux pays, les autres séquences de monuments sont plus difficiles à retracer (sur l'Ile de Man il n'y a pratiquement pas de datations disponibles des monuments). Le chapitre 14 se conclut par une révision globale de l'évolution chronologique du Néolithique ancien en Grande Bretagne et en Irlande.

Le chapitre 15 commente les scenarios présentés dans le chapitre 14. La discussion s'étendra ici depuis le début de la séquence jusqu'à la phase tardive du Néolithique ancien. Les modèles proposés dans le chapitre 14 pour le début de l'occupation Néolithique ancien sont comparés avec d'autres interprétations courantes de la littérature, allant de la colonisation jusqu'à l'acculturation autochtone. Notre interprétation est différente ; elle se fonde sur une théorie de colonisation plus large selon laquelle il y aurait probablement eu un mouvement de colonisation à petite échelle depuis le continent voisin vers le sud de l'Angleterre, suivi par une diffusion continue et accélérée d'objets et pratiques néolithiques ; ce qui impliquerait probablement une acculturation autochtone dès le début. Des modes d'occupation et des changements ont été inventorié de façon succincte sur le continent voisin et renforcent la probabilité d'une colonisation filtrée à petite échelle combinée avec un changement local. Les modes d'habitat et les stratégies de subsistance mis en évidence dans les premiers siècles du Néolithique du sud de la Grande Bretagne ont ensuite été réévalués à partir des modèles chronologiques élaborés. On a souligné qu'il n'existait pas d'indices manifestes dans le sens d'un accroissement significatif de la population ni même d'une intensification marquée des pratiques économiques. Cependant, beaucoup d'aspects demanderaient à être mieux compris notamment l'évolution de l'élevage bovin. On constate néanmoins que les monuments et la culture matérielle révèlent le plus de changements. On discutera du possible rôle social des constructions de type tumulus allongés (*long barrows*) ou des cairns allongés (*long cairns*) qui ont été érigés en plus grand nombre probablement à partir de 3800 cal BC environ. Il en va de même de l'implication de la compétition dans la définition de l'identité des groupes. La montée accélérée d'innovations matérielles tout au long du 38ième siècle cal BC qui précèdent et accompagnent l'émergence des enceintes elles-mêmes, contribue également à présupposer l'existence de conditions sociales dynamiques, vraisemblablement compétitives.

Les tenants de la construction et de l'utilisation des enceintes sur le continent mettent en évidence une longue histoire qui remonte au sixième millénaire cal BC. Les enceintes à fossés interrompus du sud de la Grande Bretagne et de l'Irlande sont plus comparables à celles du complexe Michelsberg-Chasséen du continent voisin dont on suppose l'apparition dès la fin du cinquième millénaire et dont les constructions se succèdent jusqu'au début du quatrième millénaire cal BC (bien que le manque de précision des chronologies continentales rende en général impossible la corrélation d'évènements ponctuels). La fondation des enceintes dans le sud de la Grande Bretagne, à partir de 3700 cal BC environ, plaide en faveur (en excluant la possibilité d'une arrivée de nouvelles populations) d'une action délibérée de maintenir des contacts et affiliations avec des pratiques ancestrales et de renforcer la compétition et l'émulation entre les groupes.

L'élaboration de l'histoire détaillée de la construction et de l'occupation des enceintes durant leur évolution florissante au cours des 37ième et 36ième siècles cal BC, permet de modeler une vision du monde basée sur une combinaison d'idées mélangeant des principes d'ancestralité, de savoir-faire et d'affiliations ou de relations qui s'insèrent dans un contexte spécifique. Dans ce contexte, les différentes caractéristiques des relations sociales sont prises en compte, une attention particulière est donnée au rôle probable d'experts et de personnages éminents dans l'organisation de rituels. Durant cette période, l'accent mis sur les enceintes dans le sud de la Grande Bretagne contraste avec d'autres aspects sociaux qui se développent ailleurs en Grande Bretagne et en Irlande, à une échelle probablement plus petite et moins importante, comme le démontrent la construction d'édifices et de maisons de poteaux ainsi que les formes variées de tumulus et de cairns. On remarque toutefois l'apparition de chevauchements dans la circulation des lames de haches dans des sites d'habitat irlandais, tout comme l'attention généralisée portée aux ancêtres et aux autres dimensions du passé.

De la fin du 36ième jusqu'aux 35ième et 34ième siècles cal BC évolue apparemment une société complexe caractérisée

par des innovations et des continuités. L'occupation principale de quelques enceintes à fossés interrompus se poursuit avec quelques nouvelles constructions tardives. L'innovation monumentale prend son essor au cours d'une période florissante d'environ huit générations seulement, avant de se tourner vers la construction de monuments rectilignes de type *cursus*. Les tumulus allongés (*long barrows*) et les cairns allongés (*long cairns*) continueront à être construits et utilisés. Dans l'état actuel de la documentation, il est encore difficile de décrire la situation, car beaucoup d'aspects dépassent la problématique initiale de notre projet. L'hypothèse qui pourrait être retenue serait l'augmentation de la compétition entre les groupes, ou bien encore, et de façon plus subtile, la rivalité entre des clans ou des lignées ancestrales et plus récentes.

Ce volume s'achève par une réflexion sur la notion de temps, d'action et de mémoire. Les cadres chronologiques beaucoup plus précis concernant certains aspects du Néolithique ancien du sud de la Grande Bretagne permettent de passer du concept de la « longue durée » à une histoire sociale mesurable à l'échelle de siècles, de demi-siècles, de générations et même parfois de décennies. Cette démarche ouvre la voie à une interprétation beaucoup plus détaillée des différents mécanismes de transmission entre générations et remet ainsi en question le terme de 'préhistoire'.

Traduit par Karoline Mazurié de Keroualin

Zusammenfassung

Der vorliegende Band legt die Ergebnisse eines Projektes zur Datierung der frühneolithischen unterbrochenen Erdwerke (*causewayed enclosures*) im südlichen Großbritannien und in Irland vor. Im bisher umfangreichsten Projekt dieser Art wurden hunderte von Radiokarbondaten aus fast 40 Erdwerken im südlichen Großbritannien in Bayes'sche chronologische Modelle integriert. Auf dieser Grundlage kann die Errichtung dieser Erdwerke im Wesentlichen auf den Zeitraum zwischen dem späten 38. Jahrhundert und Mitte bis Ende des 36. Jahrhunderts v. Chr. geschätzt werden. Während die Hauptnutzungsphase einiger Fundplätze bis zu drei Jahrhunderte währte, waren zahlreiche andere von viel kürzerer Dauer (sogar nur einige Jahrzehnte). Die anhand der Erdwerke erzielten Ergebnisse wurden mit anderen Erscheinungen des südbritischen Frühneolithikums verglichen, wobei auf der Grundlage hunderter von Radiokarbondaten aus anderen Monumenttypen, einschließlich Grabhügeln (*long barrows*) und Siedlungsplätzen, Bayes'sche Chronologiemodelle aufgebaut wurden. Dies zeigt, dass sich Erdwerke erst bis zu 300 Jahre nach dem Erscheinen der ersten neolithischen Gegenstände und Praktiken im 41. Jahrhundert v. Chr. etablieren. Es konnte auch nachgewiesen werden, dass der Ausbreitungsprozess der neolithischen Lebensweise sich langsam über mehr als zwei Jahrhunderte vollzog, in Südostengland begann und sich regional unterschiedlich abspielte. Die ersten *long barrows* und ähnliche Monumente erscheinen etwa ein Jahrhundert vor den unterbrochenen Erdwerken. Dutzende von Radiokarbondaten aus zwei irischen Erdwerken wurden ebenfalls bayesisch modelliert und durch einen Vergleich mit hunderten von Radiokarbondaten von anderen frühneolithischen Fundplätzen Irlands in ihren Regionalkontext eingefügt. Obwohl eines der beiden Erdwerke besondere Interpretationsschwierigkeiten bereitet, wird hier argumentiert, dass das irische Frühneolithikum wohl um 3800 v. Chr. begann.

Kapitel 1 widmet sich zentralen Fragen zum Konzept der Zeit und zur zeitlichen Auflösung. Viele Archäologen geben sich mit ungenauen Zeitmaßstäben zufrieden, was sich wiederum auf die Vergangenheitskonstrukte auswirkt, die gewöhnlich vorgeschlagen werden. Ferner gibt das Kapitel eine Einführung zu den *causewayed enclosures* und ihrer Forschungsgeschichte. Kapitel 2 legt die grundlegenden Konzepte der Bayes'schen Modellierung von Chronologien dar und beschreibt die präzisen Informationen und exakten Interpretationen, die für eine erfolgreiche Anwendung in der archäologischen Praxis nötig sind. Es werden nicht nur die entscheidenden ‚a priori' vorliegenden archäologischen Informationen – Vorwissen zur Taphonomie der Proben, sowie deren Kontext, Vergesellschaftung und Stratigraphie – diskutiert, sondern auch die statistischen Annahmen, die in das Modell einfließen. Besonderes Augenmerk liegt auf der unausweichlichen Streuung der C14-Daten für ein gegebenes Phänomen; werden keine Modelle erarbeitet, die dem entgegen wirken, führt dies dazu, dass das jeweilige Phänomen scheinbar früher beginnt, länger anhält und später endet, als in Wahrheit der Fall. Die Laborverfahren, die für genaue C14-Messungen notwendig sind, sowie eine Einschätzung der Genauigkeit der gegenwärtig vorliegenden Radiokarbondaten, werden ebenfalls dargelegt.

Im Zuge dieses Projektes wurde der südliche Teil Großbritanniens in pragmatisch definierte Regionen unterteilt (Kapitel 3–11). Jedes Kapitel stellt zunächst die chronologischen Modelle für diejenigen Erdwerke vor, die für die vorliegende Studie ausgewählt wurden. Dabei werden auch die Auswirkungen der neuen Chronologien auf unser Verständnis der individuellen Fundplätze berücksichtigt. Auf dieser Grundlage wird geschätzt, dass Erdwerke vom späten 38. bis zum mittleren/späten 36. Jahrhundert cal BC angelegt wurden. Die Hauptnutzungsdauer zahlreicher Fundplätze ist zeitlich relativ eng beschränkt, einige wurden jedoch bis zu drei Jahrhunderte lang genutzt. Die folgenden Erdwerke wurden im Zuge des Projektes datiert: Windmill Hill und Knap Hill im nördlichen Wiltshire (Kapitel 3, mit Bezugnahme auf Rybury); Whitesheet Hill, Maiden Castle und Robin Hood's Ball im südlichen Wessex (Kapitel 4, mit einer Neuanalyse der umfangreichen Serie an C14-Daten aus Hambledon Hill); Whitehawk, Offham Hill, Bury Hill, The Trundle und Court Hill in Sussex (Kapitel 5, mit Bezugnahme auf Barkhale, Combe Hill und Halnaker Hill); Maiden Bower, Haddenham, Etton, Etton Woodgate und Northborough in Ostengland (Kapitel 6, mit Bezugnahme auf Briar Hill und Great Wilbraham); Orsett, Kingsborough 1 und 2 und Chalk Hill im Bereich der Themsemündung (Kapitel 7, mit einer Neuanalyse der bereits vorliegenden C14-Daten aus St Osyth); Staines, Eton Wick, Gatehampton Farm und Abingdon im mittleren und oberen Tal der Themse (Kapitel 8); Crickley Hill und Peak Camp in den Cotswolds (Kapitel 9); Hembury und Raddon Hill, sowie die mit Steinmauern eingefassten Anlagen von Helman Tor und Carn Brea in der südwestlichen Halbinsel Englands (Kapitel 10; mit Bezugnahme auf Membury); sowie Hill Croft Field und Banc Du in Südwales und den Welsh Marches (Kapitel 11; mit der Datierung von Beech Court Farm, das sich als bedeutend jünger herausstellte, und von Billown auf der Insel Man, einer wichtigen frühneolithischen Siedlung, die aber wohl keine *causewayed enclosure* im Sinne der südbritischen Anlagen ist). Im Anschluss werden Radiokarbondaten und chronologische Modelle für andere frühneolithische Verhaltensweisen

der jeweiligen Region vorgestellt. Formale Schätzungen für das erstmalige Auftreten neolithischer Gegenstände und Praktiken werden in den Kapiteln 5, 6, 9, 10 und 11 entwickelt, weiterführende Analysen folgen in Kapitel 14. Den Abschluss jedes Kapitels bildet eine Diskussion der Auswirkungen aller regionalen Chronologien auf unser Verständnis der ersten Jahrhunderte, in denen neolithische Verhaltensweisen auftreten.

Für Irland (Kapitel 12) werden chronologische Modelle für die Erdwerke von Donegore und Magheraboy vorgestellt. Der Bau der Anlage von Donegore in der Grafschaft Antrim fällt in die Blütezeit der Errichtung südbritischer Anlagen und es wird auf den örtlichen und regionalen Kontext des Fundplatzes eingegangen. Magheraboy in der Grafschaft Sligo hat ältere Daten erbracht und scheint in das 40. und 39. Jahrhundert cal BC zu fallen. Dieses Ergebnis verlangte nach einer weiter gefassten Prüfung der Datierung des gesamten irischen Frühneolithikums. Hunderte von C14-Datierungen wurden in chronologische Modelle für weitere Monumenttypen und Verhaltensweisen eingearbeitet. Es wird geschätzt, dass neolithische Gegenstände und Praktiken im späten 39. oder im 38. Jahrhundert zum ersten Mal in Irland auftraten (zwei alternative Modelle werden diskutiert). Viele Aspekte können nicht genau datiert werden, was auch auf zahlreiche *court tombs* und Portalgräber zutrifft; Gräber vom Typ Linkardstown und Ganggräber werden als mittelneolithische Innovationen der zweiten Hälfte des 4. vorchristlichen Jahrtausends angesehen und werden benutzt, um die Modelle für das Frühneolithikum zeitlich näher einzugrenzen. Die rechteckigen, aus Holz erbauten Häuser lassen sich besser datieren und wurden lediglich vom 38. bis ins 37. Jahrhundert cal BC errichtet und genutzt. Abgesehen von domestizierten Rindern, die in Ferriter's Cove in der Grafschaft Kerry aus einer Fundschicht des späten 5. Jahrtausends bekannt sind, besteht eine schwer interpretierbare Lücke zwischen der offenbar frühen Datierung Magheraboys und den Schätzungen des ersten Auftretens neolithischer Gegenstände und Praktiken in Irland, die auf der Grundlage aller anderen chronologischen Modelle vorgeschlagen werden. Eine weiterführende Diskussion zu Irland im Rahmen des südlichen Großbritanniens folgt in Kapitel 14.

Isotopische Ergebnisse von menschlichen und tierischen Überresten aus vier südbritischen *causewayed enclosures* werden in Kapitel 13 vorgestellt. Der Vergleich mit anderen frühneolithischen Kontexten hebt hervor, dass sich Umweltgegebenheiten und Ernährung wohl recht vielfältig gestalteten.

Kapitel 14 führt alle in Kapiteln 3–12 gesponnenen chronologischen Fäden zusammen, um auf dieser Grundlage eine neue Interpretation der Entwicklung des Fühneolithikums in Südbritannien und Irland zu entwickeln. Zunächst werden die unterbrochenen Erdwerke aus dem südlichen Großbritannien analysiert, danach weitere frühneolithische Verhaltensweisen, unter Einbeziehung der Modelle für das Auftreten neolithischer Gegenstände und Praktiken im südlichen Großbritannien. Schließlich wird der Beginn des Neolithikums in Irland, auf der Insel Man und in Schottland südlich des Great Glen angeschnitten.

Zahlreiche zentrale Aspekte der südbritischen *causewayed enclosures* werden aus dem Blickwinkel der genaueren Chronologien, die jetzt verfügbar sind, untersucht. Die Geläufigkeit, Einführung und Ausbreitung dieser Erdwerksform werden analysiert und die Modelle für einzelne Fundplätze und Regionen zusammengeführt. Die ersten Erdwerke wurden in Ostengland errichtet und die Geschwindigkeit von Neugründungen stieg über drei bis vier Generationen kontinuierlich an, bis im späten 37. Jahrhundert cal BC ein Höhepunkt erreicht wurde. Zu Beginn des 36. Jahrhunderts erfolgte dann offensichtlich eine gewisser Rückgang der Bautätigkeit, gefolgt von weiteren Neubauten, die bis Mitte/Ende des 36. Jahrhunderts cal BC anhielten. Die neuen Modelle erlauben auch eine präzisere Diskussion zu weiteren Aspekten, wie zum Arbeitsaufwand, der mit der Errichtung dieser Anlagen verbunden war und an einigen Fundplätzen in konzentriertere Episoden intensiver Tätigkeit aufgeteilt werden kann; zu den Entwicklungsverläufen von Fundplätzen mit mehreren Grabenringen oder mehreren Erdwerken, die tendentiell länger als einfache Anlagen bestehen; sowie zu den Endpunkten und der sehr unterschiedlichen Dauer der einzelnen *causewayed enclosures*. Für ausgewählte Fundplätze werden modellierte Schätzungen zur Verfüllungsdauer und zum erneuten Ausheben der Grabenringe, sowie für die Intensität der Fundablagerung in Gräben vorgestellt. Die präziseren zeitlichen Rahmen zeigen dabei, dass die Fundablagerung zu einem beliebigen Zeitpunkt weniger intensiv war, als generell in der Literatur angenommen, aber selbst mit dem Fleisch von nur ein oder zwei Kühen konnte wohl eine beträchtliche Anzahl Personen bewirtet werden. Es folgt ein Vergleich mehrerer datierter Gewaltepisoden in Erdwerken, die Tötungen, Angriffe mit Pfeilen und Brandschatzung umfassen. Im östlichen Teil des südlichen Großbritanniens treten Anzeichen solcher Verhaltensweisen seltener auf.

Abgesehen von vielleicht zwei oder drei frühen Kandidaten scheinen Bauten wie *long barrows* und *long cairns* ab ungefähr 3800 cal BC in größerer Anzahl errichtet worden zu sein. Bisher können die Behauptungen, dass Typen wie Portaldolmen, kleine ovale Grabhügel oder Rotundae besonders alt seien, nicht bestätigt werden. In jeder der hier behandelten Regionen Südbritanniens kann nachgewiesen werden, dass das Erscheinen der *causewayed enclosures* nach dem Beginn anderer frühneolithischer Verhaltensweisen einsetzt. Die Intervalle sind dabei unterschiedlich, da auch die geschätzten Anfangsdaten für den Beginn anderer neolithischer Verhaltensweisen sich zwischen den südbritischen Regionen unterscheiden. Die ersten neolithischen Gegenstände und Praktiken erscheinen um die Mündung der Themse im 41. Jahrhundert cal BC und breiten sich dann, nicht unbedingt nur von einem Mittelpunkt ausgehend, nach Westen aus. In den Generationen um 3700 cal BC erreichen sie Südwales und die Welsh Marches. Chronologische Tendenzen in der Entwicklung keramischer Stile und der Herstellung und Verbreitung von Steinäxten können ebenfalls modelliert werden.

Südwestliche Keramikstile treten im 38. Jahrhundert cal BC auf, sind also jünger als der weit verbreitete und von Anfang an vertretene Windmill Hill-Stil (Carinated Bowl style) mit den characteristischen Knickwandschüsseln. Die sogenannte ‚verzierte Keramik' erscheint im späten 38. oder frühen 37. Jahrhundert cal BC, zeitgleich mit oder kurz nach dem ersten Auftreten der *causewayed enclosures*. Steinäxte scheinen ebenfalls vom 38. bis ins 37. Jahrhundert cal BC hinein in Umlauf gewesen zu sein. Diese Entwicklungen bündeln sich zu einer beschleunigten Innovationsrate, die durch das gesamte 38. Jahrhundert cal BC hindurch anhält und dem Auftreten der Erdwerke selbst vorangeht oder es begleitet. Dieser Teil des Kapitels 14 endet mit einer systematischen Zusammenschau der grundlegenden Elemente in der Entwicklung des Frühneolithikums im gesamten südlichen Großbritannien.

Kapitel 14 beschäftigt sich ferner mit einem Vergleich der frühneolithischen Entwicklung in Irland (auf der Grundlage von Kapitel 12), auf der Insel Man (aus Kapitel 11) und in Schottland (unter Nutzung verfügbarer Radiokarbondaten aus dem Gebiet südlich des Great Glen). Die modellierten Schätzungen zur Datierung weisen darauf hin, dass der Beginn frühneolithischer Verhaltensweisen in Irland und Schottland ins späte 39. oder an den Anfang des 38. Jahrhunderts cal BC fällt, auf der Insel Man vielleicht ins 38. Jahrhundert cal BC. Die hölzernen hallenartigen Häuser Schottlands und die irischen Häuser werden als frühe Komponenten neolithischer Verhaltensweisen definiert; die Abfolge anderer Monumenttypen ist für beide Regionen schwerer nachzuvollziehen (und für die Monumente der Insel Man gibt es fast keine C14-Daten). Kapitel 14 endet mit einer Gesamtübersicht zur chronologischen Entwicklung des Frühneolithikums in Großbritannien und Irland.

Kapitel 15 kommentiert die in Kapitel 14 dargelegten Interpretationen. Die Diskussion orientiert sich am Ablauf der Ereignisse vom Anfang bis zum späteren Abschnitt des Frühneolithikums. Die in Kapitel 14 vorgestellten Modelle zum Beginn frühneolithischer Verhaltensweisen werden mit anderen einflussreichen Interpretationen aus der Literatur verglichen, die von Kolonisation einerseits bis zur Akkulturation einheimischer Jäger- und Sammlergruppen andererseits reichen. Hier wird ein alternativer Interpretationsweg eingeschlagen, der auf einer weiter gefassten Kolonisationstheorie fußt. Nach dieser Auffassung gab es wohl, in kleinerem Umfang, eine gewisse Kolonisationsbewegung aus den benachbarten Regionen Kontinentaleuropas nach Südengland. Dem folgte eine anhaltende und sich stetig beschleunigende Verbreitung neolithischer Gegenstände und Praktiken, die wahrscheinlich von Anfang an auch die Akkulturation einheimischer Bevölkerungsgruppen umfasste. Siedlungsmuster und Veränderungsprozesse auf dem benachbarten Festland werden kurz angerissen um das Argument einer gefilterten Kolonisationsbewegung geringen Umfanges, kombiniert mit örtlichen Veränderungstendenzen, wahrscheinlicher zu machen. Im Folgenden wird Beweismaterial zur Siedlungsstruktur und Ernährungsweise in den ersten Jahrhunderten des südbritischen Neolithikums im Lichte der chronologischen Modelle neu bewertet. Es gibt weder deutliche Hinweise auf einen massiven Anstieg der Bevölkerungszahl noch eine deutliche Intensivierung wirtschaftlicher Praktiken. Vieles muss jedoch noch besser untersucht werden, vor allem auch die Entwicklung des Rinderhütens. Andererseits zeigen Monumente und materielle Kultur deutlichere Anzeichen von Veränderung. Es wird auf die möglichen sozialen Rollen eingegangen, die Anlagen wie *long barrows* oder *long cairns* beispielsweise im Zuge der Definition von Identitätsgrenzen miteinander konkurrierender Gruppen spielten; sie wurden wahrscheinlich ab ungefähr 3800 cal BC in grösserer Zahl errichtet. Das sich ständig beschleunigende Aufkommen materieller Neuerungen hielt durch das gesamte 38. Jahrhundert cal BC an, begann also vor der Errichtung der ersten Erdwerke und begleitete dann deren Entwicklung. Es weist ebenfalls auf dynamische, vielleicht auf Konkurrenzverhalten basierende gesellschaftliche Verhältnisse hin.

Der kontinentaleuropäische Hintergrund zu Bau und Nutzung von Erdwerken zeigt eine lange historische Entwicklung auf, die bis ins 6. Jahrtausend cal BC zurückreicht. Die unterbrochenen Erdwerke im südlichen Großbritannien und in Irland lassen sich am besten mit denen des Michelsberg-Chasséen Komplexes auf dem benachbarten Festland vergleichen, die angeblich bereits ab dem späteren 5. Jahrtausend auftreten, aber noch bis ins frühere 4. Jahrtausend hinein erbaut werden (allerdings macht die Ungenauigkeit der zur Verfügung stehenden Chronologien auf dem europäischen Festland eine Aufschlüsselung detaillierter Beziehungsgeflechte zum gegenwärtigen Zeitpunkt unmöglich). Die um 3700 cal BC einsetzende Errichtung von Grabenwerken im südlichen Großbritannien weist (abgesehen von der Möglichkeit einer Einwanderung neuer Bevölkerungsgruppen) auf einen gewollten Versuch hin, sich auf Kontakte und Gemeinsamkeiten mit ferneren Regionen und deren Praktiken zu berufen und unterstützt die Idee von Wettbewerb und Nachahmung zwischen sozialen Gruppen.

Weltanschauungen waren um einen zentralen Ideenkomplex gruppiert, der Prinzipien einer altersbedingten Rangstruktur, dem Beweisen von Können und Tapferkeit, sowie Zugehörigkeit und Beziehungsnetzwerke umfasste. Die detailliert nachgezeichnete historische Situation der Errichtung und Nutzung von *causewayed enclosures* während ihres Höhepunktes im 37. und der ersten Hälfte des 36. Jahrhunderts cal BC verankert diesen Ideenkomplex in einem bestimmten Kontext, für den hier verschiedene Ansätze zu potentiellen sozialen Beziehungen in Betracht gezogen werden. Ein Hauptaugenmerk liegt dabei auf der möglichen Rolle ritueller Experten und Organisatoren mit einer gesellschaftlichen Vorrangstellung. Der Schwerpunkt, der zu dieser Zeit im südlichen Britannien auf Erdwerke gelegt wird, steht alternativen Modalitäten des gesellschaftlichen Zusammenlebens gegenüber, die in anderen Regionen Großbritanniens und Irlands vorherrschten und vielleicht als kleinräumiger ausgerichtet und weniger intensiv

beschrieben werden können. Sie zeigen sich beispielsweise in der Errichtung von hölzernen hallenartigen Gebäuden und Häusern und in den verschiedenen Arten von Grab- und und Cairnkonstruktionen. Allerdings gibt es auch Übereinstimmungen, die sich etwa in der Zirkulation von Steinäxten zwischen einigen irischen Hausfundplätzen und in einer weit verbreiteten Ehrfurcht gegenüber Ahnen und anderen Aspekten der Vergangenheit andeuten.

Vom späten 36. bis ins 35. und 34. Jahrhundert cal BC scheint eine komplexe Welt aus Innovationen und Kontinuitäten bestanden zu haben. Obwohl die Erstnutzungsphase mancher unterbrochener Erdwerke anhielt und es möglicherweise einige späte Neuerrichtungen gab, verschob sich das Streben nach monumentalen Innovationen, nach einer Blütezeit von nur circa acht Generationen, hin zur Errichtung linearer Cursus-Monumente. *Long barrows*, *long cairns* und wohl auch Portaldolmen wurden weiterhin errichtet und genutzt. Bei gegenwärtiger Beweislage und mit zahlreichen noch ungeklärten Aspekten, die jenseits der Zielsetzungen dieses Projektes lagen, ist es schwer, die Situation präzise zu beschreiben. Mögliche Erklärungsansätze könnten entweder eine Intensivierung des Konkurrenzverhaltens zwischen sozialen Gruppen beinhalten, oder sich auf subtilere Prozesse, wie beispielsweise Rivalitäten zwischen Clans oder Lineages unterschiedlichen Ranges berufen.

Der vorliegende Band endet mit weiteren Überlegungen zu verschiedenen Auffassungen von Zeit, Vergangenheitsbezug und zielgerichtetem Handeln. Der jetzt viel genauere zeitliche Rahmen für einige Aspekte des Frühneolithikums im südlichen Großbritannien ermöglicht es, den Schwerpunkt unseres Interesses von der *longue durée* hin zu einer Sozialgeschichte zu verschieben, die man in Einheiten von Jahrhunderten, halben Jahrhunderten, Generationen und manchmal sogar Jahrzehnten messen kann. Auf diese Weise öffnen sich mögliche Überlieferungsprozesse zwischen den Generationen einer viel genaueren Analyse und erhellen so Teilaspekte der ‘Vorgeschichte’.

Übersetzt von Daniela Hofmann

Abbreviated list of figures

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1 Gathering time: causewayed enclosures and the early Neolithic of southern Britain and Ireland

Alasdair Whittle, Frances Healy and Alex Bayliss

> The long run is a misleading guide to current affairs. In the long run we are all dead. Economists set themselves too easy a task…if they can only tell us that when the storm is past the ocean is flat again.
>
> Maynard Keynes, *A tract on monetary reform* (1923)

1.1 Prehistorians and chronological resolution

'There is no history without dates': thus Claude Lévi-Strauss (1966, 258) towards the end of *La pensée sauvage*. To this leading anthropologist of a generation ago, it seemed self-evident that to write history required quantification of the lapse of time. In contrast, the thinking of most prehistorians has been characterised by a time that is either entirely un-quantified, or by one that is confined to a vocabulary of millennia, half-millennia or at best quarter-millennia. In this volume, we seek to challenge this fuzzy prehistory, and to show, in this provisional, first account, how a very different kind of history can emerge.

Chronology has not been entirely neglected. In continental European Neolithic studies, laborious attention has long been given to building chronologies, but often within a restrictive model of culture history (Whittle 1988a), and often with calendar dates serving only as occasional hooks on which long relative sequences are hung. In British Neolithic studies, chronology building since the advent of radiocarbon dating has tended to rely on informal estimates based on visual inspection of calibrated radiocarbon dates. In contrast, the Neolithic dendrochronologies of the Alpine foreland stand out for providing astonishing timetables, which are both detailed and reliable (Menotti 2004); a striking recent example is the dating of the life of one settlement, Arbon Bleiche 3 in northern Switzerland, to a mere 15 years, between 3384 and 3370 BC (Jacomet *et al.* 2004). But this precision is confined to the domain of settlement and the everyday at discrete locations. The detailed individual site biographies of the Alpine foreland tend to float separately from wider generalisations about the pattern of long-term change (including, for example, a gradual shift in subsistence staples, extending scales of clearance, and increases in site size and duration). It is not clear that these detailed site chronologies have yet contributed to a fundamentally different kind of prehistory.

In the different settlement record and the wide array of monuments characteristic of Britain and of north-west Europe as a whole – but largely lacking in the Alpine foreland – a recurrent perspective has emerged. This allows us to investigate the cycles of daily life, the broad outlines of social relationships and the essential elements of worldview, perhaps even including something of the experience of time, and the slow turn of cultural change, within an imprecise timeframe that necessarily floats across centuries. Given our general reliance on radiocarbon dating and its inherent imprecision, this may seem both natural and unavoidable, but this can now be challenged.

This book is about the dating of the early Neolithic causewayed enclosures of southern Britain and of Ireland. Using chronological estimates produced by Bayesian statistical analysis of hundreds of radiocarbon dates, it establishes that these ceremonial arenas, the loci for gathering, construction, intense social interaction, and deposition, began in southern Britain in the late 38th century cal BC, and flourished principally in the 37th and 36th centuries cal BC. By interpretation in a Bayesian chronological framework of more than a thousand other radiocarbon dates from other kinds of contexts, the volume also shows that causewayed enclosures were preceded, by some three to four centuries, by the first Neolithic activity in southern Britain; the initial establishment and spread of Neolithic things and practices was gradual, from the 41st century cal BC in south-east England onwards, and probably did not reach the majority of Britain and Ireland till around 3800 cal BC. The first monuments to be built, long barrows, long cairns and other related forms, were in existence by that date, and a series of other accelerating changes can begin to be detected during the course of the 38th century cal BC. Some causewayed enclosures went on to have a long history, the initial use of a few continuing into the 34th or 33rd centuries cal BC, but these have proved the exception rather than the norm; probably from

the mid- or later 36th century cal BC, a new linear kind of construction, the cursus monument, came into fashion, and in the 35th and 34th centuries cal BC there was a mixture of tradition and innovation which challenges many of our current assumptions and interpretations.

This outline, we believe, begins to offer a new view of the historical development of the early Neolithic in southern Britain, and we present too a first sketch of new possibilities for the early Neolithic in Ireland, where enclosures were far scarcer. Is this approach of interest, as we hope it will be, only for specialists in the study of the Neolithic period in Britain and Ireland, or at a pinch, in north-west Europe more broadly? Or is it of more fundamental importance, as we think it should be, for prehistorians and other archaeologists everywhere so far lacking detailed control of chronological sequence? The effort of the project could have been directed, after all, at any number of other kinds of site, period or area. So we begin by reflecting further on the interpretation and resolution of time, and this general concern with the kind of prehistory that we can now write will also run through the whole volume and form its endnote.

How then have prehistorians, say over the last 60 years, got on with time? The simple or widely provided answer would point to chronological schemes based on typologies and seriations of material culture assemblages, to dendrochronologies in the few areas blessed with the necessary conditions of organic preservation, and above all to the advent and development of radiocarbon dating, through a series of well documented revolutions: from initial establishment, to calibration, to the use of much smaller samples in accelerator mass spectrometers (Renfrew 1973a; R. Taylor 1995; Bayliss 2009). There have been stunning successes. The word 'revolution' can be over-used but there is a genuine gulf between pre-radiocarbon and post-radiocarbon prehistories. Calibration in particular enabled prehistorians to isolate the local or regional from the general, and to track processes of change over the long term. But developments of this kind, as Chapter 2 will set out in much more detail, did not radically improve the precision as opposed to the accuracy of the radiocarbon method, and dates were routinely and universally interpreted on an informal basis, by visual inspection. Using this approach, archaeologists generally incorrectly estimate the start and end dates of given phenomena, and overestimate their durations, and while long-term trends may be visible, precision is still elusive. Suppose, however, that historians were unable to separate processes and events in England in the fourteenth, fifteenth and sixteenth centuries AD. In that scenario, the decline and then re-establishment of kingship, factional struggles, the end of feudalism, the growth of the more centralised Tudor state, the Black Death, the beginnings of enclosure, religious upheaval, and innumerable shifts in foreign policy, to name but a few factors (Elton 1974), would all be inextricably mixed together.

As Chapter 2 sets out in much more detail, formal date estimates of much greater precision can now be achieved by implementing Bayesian statistics to model archaeological chronologies explicitly (Bayliss and Bronk Ramsey 2004). This approach is not new. The mathematics for its application to radiocarbon dating have been developing since the 1990s (Buck *et al.* 1991; 1992; Christen and Litton 1995; Christen *et al.* 1995; Bronk Ramsey 1995; 2009a; Nicholls and Jones 2001) and many other projects have been successfully carried out with it (Bayliss 2009). But most of these are either site-based studies, valuable in their own right but limited by lack of a corpus of sites dated to a similar resolution for comparison, or general studies of typological or phasing sequences which simply aim to provide more robust and precise chronologies for particular aspects of prehistory. One of the aims of this study, in contrast, is to demonstrate what may be possible when Bayesian techniques are applied routinely to all aspects of a particular archaeological period or problem. What sort of prehistory could emerge if all radiocarbon dates for the British Neolithic were in future measured on samples selected by the criteria employed here and modelled using the methods adopted in this study? Within British archaeology the benefits of such an approach are beginning to be appreciated, and the skills-base necessary for its routine implementation is beginning to be developed. The implications of the approach, however, have not yet reached general consciousness within the wider discipline, and so another aim of this volume is to accelerate and reinforce that process.

Another kind of catching up can be seen in the broader, more reflective interpretation of time and timescales that can be traced back to the end of the 1970s and the 1980s, and which has then accelerated from the 1990s through to the present. Gavin Lucas has usefully discussed many of the key texts in his *The archaeology of time* (2005), so this initial account can be brief and selective. From the first general reflections of Mark Leone (1978) and Michael Shanks and Christopher Tilley (1987), and the detailed treatment of anthropological perspectives by Alfred Gell (1992) and Tim Ingold (1993), to more concentrated archaeological approaches offered for example by Douglass Bailey (1993), Richard Bradley (1991; 2002), Chris Gosden (1994; Gosden and Lock 1998) and Dušan Borić (2003), increasing numbers of prehistorians and archaeologists in general have concerned themselves with the experience and flow of time, and from that with issues of the social construction of time, of memory and forgetting, and of the nature of the past in the past. There have been discussions of the philosophy of time, going back to McTaggart, Heidegger, Bergson and Merleau-Ponty (Gell 1992; Ingold 1993; Lucas 2005, chapter 1). What might seem like the abstract discussions of, for example, McTaggart's A-series (described in terms of tense) and B-series (described in terms of succession) time, or the retentions and protentions of the experience of the flow of time first perhaps fully propounded by Heidegger (building on initial reflections by Husserl), have been brought into more concrete interpretations of different aspects of the European Neolithic. There has been a surge in studies of

memory (and forgetting), and the popular notion of an abiding consciousness of ancestors, though it can probably be traced to other sources as well, fits in well here. What can be loosely called the social construction of time has also benefited from renewed anthropological attention, itself with a distinguished longer history (briefly documented also by Lucas (2005, 61–7)). The recent volume *The qualities of time* (James and Mills 2005) seeks to move beyond characterisations of a sense of time as cultural representation or norm, to better understanding of how ideas about time affect action, history and tradition.

These are therefore, in many ways, fertile interpretive times. The approaches noted underpin part of our own interpretations in this volume of the historical significance of causewayed enclosures and other sorts of early Neolithic construction and practice. But it is important to stress that these kinds of enquiry have so far been followed within a very generalised chronological framework. There has been a tendency to downplay sequence as 'mere chronology', as the order of beads on a string, in the search for history and temporality (Ingold 1993). On another tack, general dicta about the span and reach of memory have been offered, for example by Richard Bradley (2002, 8) on a claimed 200-year maximum duration for the normal transmission of unaltered oral traditions.

This is not to claim that no attention has been given, alongside these other developments, to timescales and time resolution, but this has mostly been in favour of the longer-term perspective, in varying forms. Geoff Bailey (1981; 1983; 2007) proposed 'time perspectivism', 'the belief that differing timescales bring into focus different features of behaviour, requiring different sorts of explanatory principles' (G. Bailey 1981, 103). This view draws attention to different timescales, and especially 'the relatively coarse temporal resolution and palimpsest nature of much of the archaeological record; [and] the possibility that the increased time depth and varied time resolution of observation afforded by archaeological data might allow us to perceive phenomena and processes not visible at smaller scales of observation' (G. Bailey 2007, 199). In claiming that 'different sorts of phenomena are best studied at different time scales', Bailey goes on to argue that (2007, 201–2):

> …the analysis of small-scale phenomena such as individual agency, inter-personal interactions and perception, which have become such a dominant tendency in recent archaeological interpretation, is better focused on observations of, say, present-day practices or recent historical periods rather than the deeper prehistoric past.

The 'palimpsest' nature of the formation of the archaeological record brings in the problem of chronological control, and in general a very pessimistic view of the possibility of achieving chronological precision is taken (G. Bailey 2007, 206). This volume strongly disagrees with this stance (see also J. Harding 2005), since it appears to accept that past difficulties in achieving chronological precision are fixed for all time, and cannot be countered, and appears to lump all manner of archaeologies and archaeological records crudely together. It is telling that the substantive example offered in the most recent presentation of time perspectivism is to do with long-term erosional processes in Greece, for which we would advocate, instead, interrupting the sequence at any one point, to examine change over the short-term. Without this, it is pointless to declare in advance that change is long-term only. Nonetheless, the vision of 'the intersection and interweaving of many different sorts of processes with different sorts of temporal rhythms – operating over different time spans and with different frequencies and amplitudes of variation' (G. Bailey 2007, 214) raises important challenges which must be faced over the course of this volume.

Another obvious approach favouring the long term is that inspired by the *Annales* school of history (Bintliff 1991; Knapp 1992; cf. Lucas 2005, 16–17), and especially the application of the concept of *la longue durée* found in the early work of Ferdnand Braudel (1975). As Geoff Bailey has commented (2007, 201), 'archaeologists who feel most comfortable identifying with this approach [*Annales*] are generally those who work on recent millennia with a time depth and resolution of data quite similar to historians, inclined to consign phenomena of greater time depth to Braudel's somewhat indeterminate *longue durée*'. The simple *Annales*-derived approach downplays the shorter timescales of *l'histoire événementielle* and medium-term social history but it is important to stress that the substance of Braudel's classic treatment of the sixteenth-century Mediterranean is in fact precisely at these scales. The opening rhetoric, which has swayed many prehistorians resigned to having coarse or fuzzy chronology, is about long duration and deep time, but the vast majority of the book deals with a combination of individual and social histories. Nor are the relationships between the different timescales and processes, even though there are claims to have identified them (e.g. Cobb 1991), often directly addressed.

Other important variations on this theme are to be noted. John Robb (2007) has argued for the need to get beyond a kind of 'ethnographic present' to produce accounts of change at much longer timescales (2007, 287), referring to a scale of 'spans of time up to several centuries' (2008, 57). For him, 'explaining long-term change has been a striking lacuna in recent archaeological theory' (Robb 2007, 287), with accounts trapped in a kind of ethnographic timeframe of a generation or so (Robb 2007, 291). Specifically in his study of long-term change in the Neolithic Mediterranean, he has called for fresh perspectives on 'how humans make their history on a scale beyond experience of a single lifetime' (Robb 2007, 3), and argues that 'the timescale of most interest for observing historical workings of practice is likely to be neither the span of decades nor of millennia, but on the order of a few centuries' (Robb 2007, 294); 'the pace of change is likely to be highly variable, with great stability and slow, gradual change punctuated by episodes of rapid change' (Robb 2007, 295). But overall, the Neolithic sequence is in general smoothed, though

there are 'at least three distinct moments of change', with much continuity, change happening 'in degrees without abrupt ruptures, even when the aggregate transformation over long epochs was dramatic' (Robb 2007, 320–21). In this approach to the long term, there is a chronological frame, but timing and tempo tend to be subjugated to the bigger, overall picture.

Ian Hodder's recent synthesis of the Çatalhöyük project argues, alongside other, particular themes, for a 'big picture' change over the span of the occupation of the east mound (*c.* 7400–6000 cal BC), from what he calls the 'prowess-animal spirit-hunting-feasting network', involving also notions of ancestry (Hodder 2006, 236–7, 245), to one concerned more with the individual house, domestic and specialised production, and exchange, evident in the upper levels (Hodder 2006, 251, 255–6). The big picture is made even bigger, and the sequence longer, by claiming that practices of feasting and public ceremony did not begin with settled life, but preceded it (Hodder 2006, 236), and, like Andrew Sherratt, Hodder argues that sedentism was the long-term outcome of other factors and processes (including what he calls 'material entanglement') rather than the other way round (2006, 242). What is further distinctive in this account is the view of timescale. The emphasis is on very gradual, slow change: through 'myriad small steps' (Hodder 2006, 251), a 'long-term process of slow gradual change' and 'infinitesimal moves in daily life and daily practices' (Hodder 2006, 236). The process of social and material entanglement 'happened incredibly slowly' (Hodder 2006, 240), though the details of that process have yet to be resolved.

Gavin Lucas (2008, 61) has argued that 'when it comes down to it, an event defined from a historical or sociological perspective does not really work well with archaeological phenomena', and, rather like Geoff Bailey, suggests that concepts of palimpsest, evoking the 'aggregate nature of the record' are more appropriate. In the Mediterranean field, despite much tighter timeframes (Foxhall 2000), Christopher Witmore has urged the use for landscape studies, especially those based on survey data, of ideas of 'percolating time', which the ensemble of the landscape produces, rather than the other way round (2007, 196; cf. Bender 2002). A rather similar position has been expressed by Laurent Olivier; 'the past itself is not made up of a series of successive temporalities but is basically multi-temporal at any time' (2001, 69–70).

Contrary to these varied suggestions, finally, a significant case has been made for the importance of events. Drawing on the historical thesis of William Sewell (2005) that events are transformative of structure, by creating ruptures between material resources and their associated conceptual schemas, Beck *et al.* (2007; cf. Bolender 2010) have argued that events were responsible for many major transformations in the archaeological record, citing cases in Bronze Age Denmark, the emergence of Cahokia, and elsewhere. The approach is very appealing, in that it draws attention again to the short term, but it is not without its own problems. There is the fundamental problem that Sewell (2005, 210) defines other situations which did not produce (or appear to produce) structural transformation merely as 'episodes', and the related difficulty that in the cases offered by Beck *et al.* (and indeed by Sewell) one can detect not single events but a series of developments over a period of time that might equate to Braudel's social history or medium-term *conjoncture*, to be measured in generations. Events in these terms are part of the flow of short- and medium-term process.

Prehistorians therefore have got on with time in a partial, selective and incomplete way.

Imprecise chronologies and long-term perspectives are all very well, if change is really played out over the long-term. But do we know that this is always the case? Does the imprecision of our chronologies smear short-term change over centuries of uncertainty (Baillie 1991) and make it appear, erroneously, to emerge piecemeal over extended timescales? It is possible to aggregate short-term chronologies to study the long-term, but not to utilise long-term data to look at shorter timescales. Having said this, so far there has been little attempt to exploit the detailed biographies of particular sites provided, for example, by dendrochronology, to examine the pace of change or to untangle webs of inter-related development at the temporal scale of the people and communities who experienced them. Partially this is because, working from the base up, it is so easy to drown in detail; and partially because it is so hard to amass a sufficient, and representative, corpus of well-dated sites for such an exercise to be feasible (Bayliss 2009, 142). We need, however, to move from the measurement of elapsed time, to a sense of successive events, and then to how people experienced the flow of time and saw themselves in time. Refined chronologies bring into focus the social context in which agency, change and the choices of individuals and communities occurred. Without time there is no history, and without history our view of human agency, identity, choice, and values must remain substantially incomplete.

1.2 The early Neolithic in southern Britain and Ireland: a note for the general reader on the wider context

Specialists will need no introduction to the familiar ground of the early Neolithic in Britain and Ireland. The general reader or specialists in other fields will want to be aware that in focusing on this period in these areas, from the very late fifth well into the fourth millennium cal BC, we are investigating part of a much longer and wider history. There are, at one level, and in deliberately simple terms, two principal threads. By this time hunter-gather populations had been established in Britain and adjacent parts of continental Europe since recolonisation following the last glacial maximum and in Ireland since early in the Holocene (McCartan *et al.* 2009). Neolithic farmers began to appear in south-east Europe in the seventh millennium cal BC, and had appeared in central and western continental Europe as the LBK (*Linearbandkeramik*) by the middle

of the sixth millennium cal BC (Whittle 1996). The two threads intertwine. New practices and ways of thinking were probably brought in some situations by new people, but the people already there were part of the processes of change, resisting, delaying, adopting and altering slowly or quickly, according to local and regional circumstance.

The LBK world probably encompassed a range of such actors and processes. This was focused on the timber longhouse, but already included some ditched and palisaded enclosures. By approximately the middle of the fifth millennium cal BC, that world changed. By and large timber longhouses disappeared, and a different pattern appeared of dispersed settlements or occupations, with many more enclosures, and a whole range of constructions containing remains of the dead – and over much wider areas of continental western and central Europe, taking the Neolithic way of life for example north into Scandinavia and west to Brittany and central-west France. Complicated interaction between newcomers and the people already there continued, constituting much of the action of the mid- and later fifth millennium cal BC (Whittle 1996; Whittle and Cummings 2007).

Britain and Ireland were now drawn into wider processes of change. This was the time when hunter-gather lifeways were replaced by Neolithic ones. Circumstances differed greatly on the two islands (Cooney 2000a). Ireland had a restricted wild fauna, in which wild boar was the only substantial source of meat, and, by the fifth millennium, had developed a distinctive heavy-blade lithic industry which lacked the microliths which had characterised the earlier industry. In Britain, on the other hand, the wild fauna was similar to that of adjacent parts of the continent, including red and roe deer and wild cattle as well as wild boar, and microliths continued to feature in the narrow-blade lithic industry.

New things and practices appeared in both Britain and Ireland, including an increased scale of woodland clearance, the cultivation of cereals, the keeping of domesticated animals, bowl-shaped pottery, leaf-shaped arrowheads, and ground stone[1] and flint axes, some of them moved or exchanged over considerable distances. People now built rectangular timber structures, and the very varied range of constructions dubbed 'monuments', including again barrows and cairns containing remains of the dead – and causewayed enclosures. That these enclosures were numerous in southern Britain but apparently scarce in Ireland (Fig. 1.1) is only one sign among many that the uptake of innovations which marked the unfolding of the Neolithic was probably different in detail on the two islands. They form the principal theme of this study, but in placing them more precisely in their times, the wider early Neolithic context also comes into sharper focus.

1.3 Causewayed enclosures in southern Britain and in Ireland

Causewayed enclosures (Fig. 1.2) consist of single or multiple circuits and other lengths of interrupted ditch, sometimes with surviving banks (Fig. 1.3), and range in area from over 8 ha to less than 1 ha. Their ditches, especially, contain varied and sometimes rich deposits of human bone, food remains, digging implements and artefacts. These monuments have been pivotal to any understanding of the first part of the Neolithic in southern Britain since they were recognised as a distinct class in the first half of the twentieth century (Cunnington 1909; Curwen 1930). There are now over 70 certain or probable examples and almost as many possible ones in Britain (Fig. 1.2). Their significance for thinking about the period in the twentieth and twenty-first centuries is mainly due to their large size compared with other early Neolithic earthworks, to their often rich cultural assemblages, and to the stratified sequences which they provide. In Ireland, by contrast, only two certain examples are known, and, of these, Donegore was first recognised in the early 1980s, while Magheraboy was discovered in 2001. The story in Ireland has therefore been different (Cooney 2000a; and see Chapter 12 for more detail), though the potential significance of enclosures for the nature of beginnings and early settlement and other questions has not been neglected in the recent literature (Cooney 2007a; Danaher 2007).

The history of investigation in southern Britain is summarised by Alastair Oswald *et al.* (2001, 9–34). The complexity of the sites and their contents have prompted multiple interpretations, through which common threads have run across the decades, their weave shifting with the *Zeitgeist*, as summarised by Chris Evans (1988c), Mark Edmonds (1999, 80–108), Julian Thomas (1999, 38–45) and Alastair Oswald *et al.* (2001, 120–32). The sheer quantity of the debris of living in the ditches of many – greater than in other kinds of contemporary site – has recurrently prompted identification of a settlement component. The ditch segments themselves were initially seen as pit dwellings. In discussion following a lecture to the Society of Antiquaries in 1928 on his excavations at Abingdon, Oxfordshire, E.T. Leeds 'was not prepared to say why Neolithic man lived on the silting. The four hearths in the trenches were good evidence of occupation. At Sutton Courtenay he had unearthed a Saxon dwelling with an ox skull and split bones on the floor, and concluded that primitive man was proof against such inconveniences' (Leeds 1928, 477). The inhabitants were later moved from the ditches to the interior, some sites being seen as settlement enclosures, exemplified by Mortimer Wheeler's Neolithic 'town-ditches' at Maiden Castle, in Dorset (1943, 85). Fortification and defence, originally inferred from superficial similarity to Iron Age hillforts (Cunnington 1909), returned to the fore in the 1980s with evidence for hostilities at sites such as Crickley Hill in Gloucestershire (Dixon 1988a; 1988b) and Hambledon Hill in Dorset (Mercer 1988). A role in animal herding, prompted by the abundant domestic fauna, was seen by Cecil Curwen in the multiple entrances (1954, 79), by Stuart Piggott in a kill pattern suggestive of the autumn slaughter of young cattle that could not be carried through the winter (1954, 29), and by him and by Graeme Barker and Derek Webley

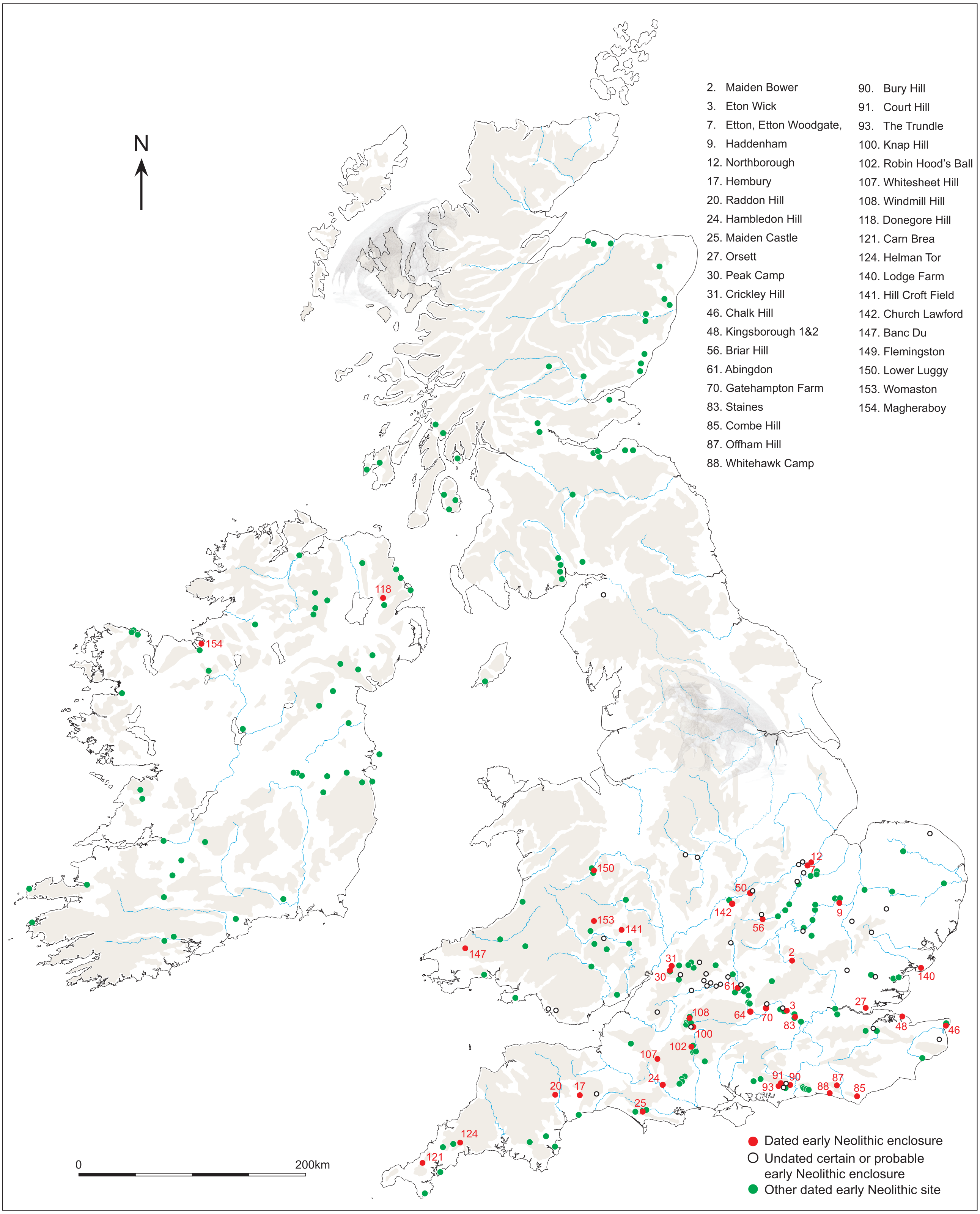


Fig. 1.1. The scope of the project. Dated early Neolithic enclosures in Britain and Ireland, mapped with undated certain or probable early Neolithic enclosures and with other dated early Neolithic sites considered in the text. The latter are confined to southern England, south and mid Wales, Ireland, and Scotland south of the Great Glen. Enclosures are numbered in the sequence of Oswald et al. *(2001, fig. 1.1 and gazetteer) with some deletions and with additions starting at 140. Dragons lurk over areas not modelled in this study.*

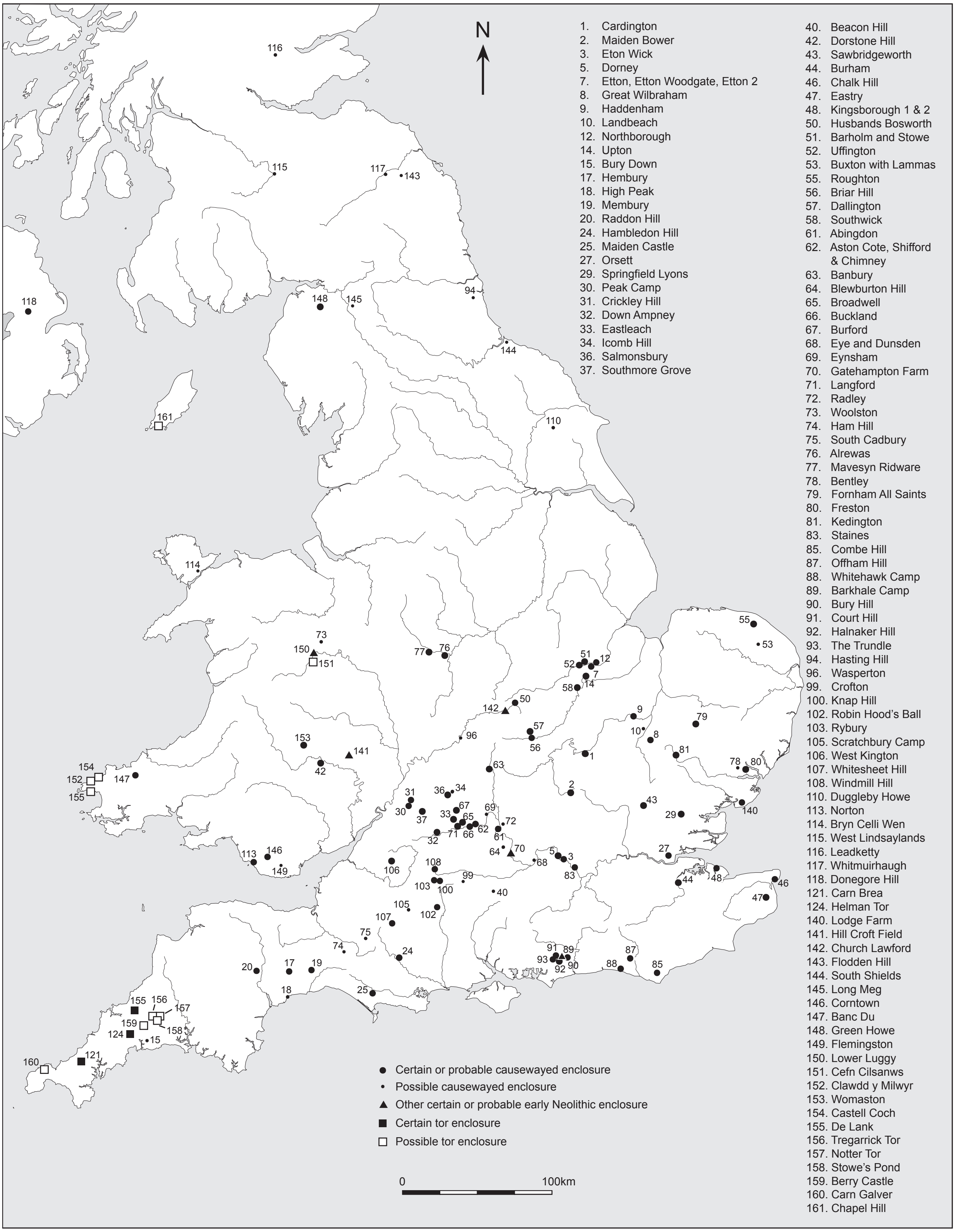


Fig. 1.2. The distribution of certain, probable and possible causewayed enclosures, tor enclosures and other early Neolithic enclosures in Britain. Sites are numbered in the sequence used by Oswald et al. *(2001, fig. 1.1 and gazetteer), with some deletions and with additions starting at 140.*

Fig. 1.3. A reconstruction of the Whitehawk causewayed enclosure in its complete state. Drawing by Ian Dennis.

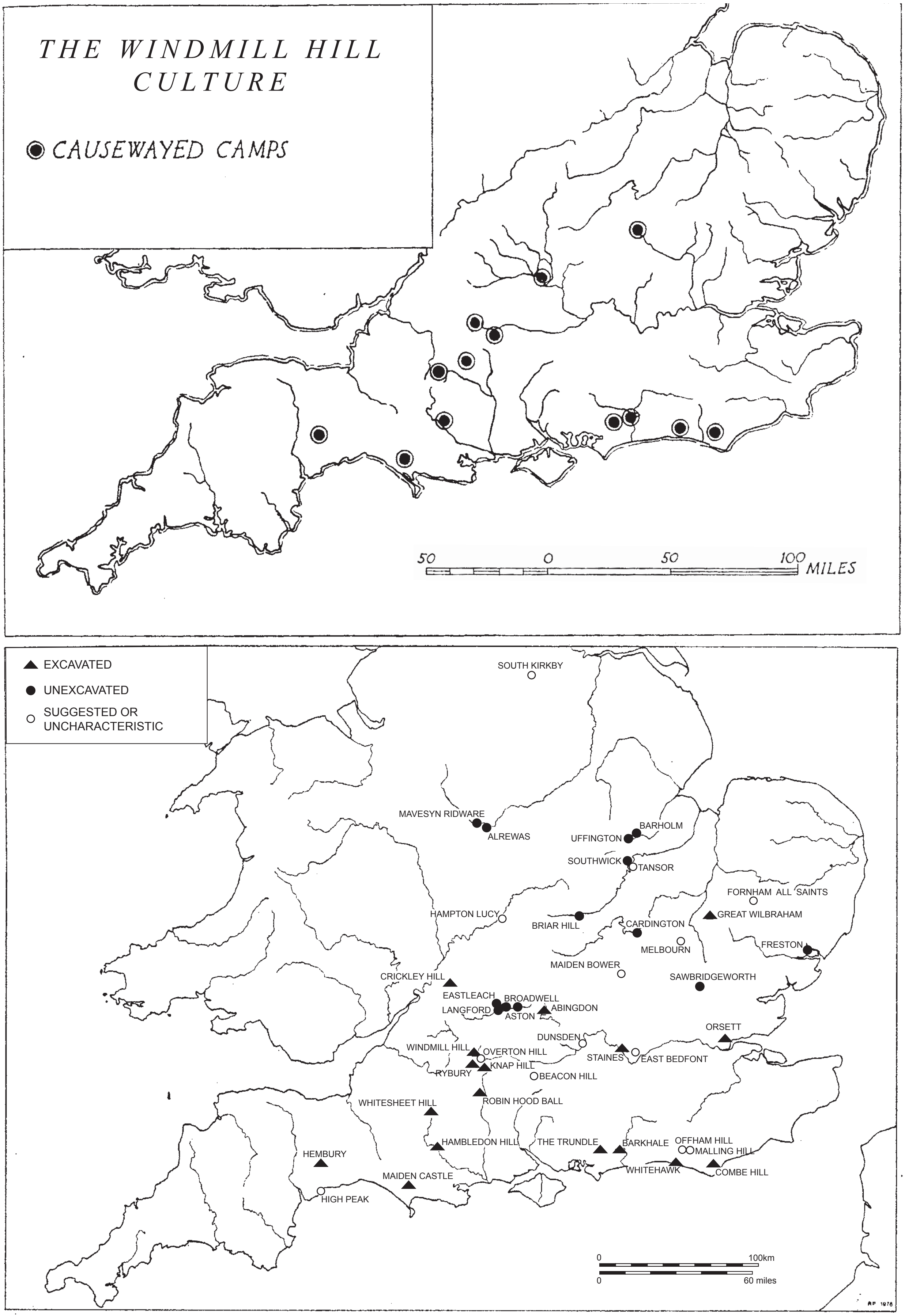


Fig. 1.4. The distribution of causewayed enclosures in the 1950s (upper) and the 1970s (lower). After Piggott (1954, fig. 1) and Palmer (1976a, fig. 1).

Fig. 1.5. Encampments for the excavations on Hambledon Hill, in 1974, with ground mist (upper), and below the hill in 1976, in wetter conditions (lower). Photos by Rog Palmer.

(1978, 171–3), in the proximity of potential pasture. The frequency of pottery and lithics from remote sources, sometimes of finer quality and manufacture than local products, suggested that causewayed enclosures were foci for the exchange, consumption and deposition of significant objects (I. Smith 1971, 102–5; R. Bradley 1984a; Mercer 1986; Edmonds 1993b). Isobel Smith was among the first to recognise that deposits in causewayed enclosure ditches may have had 'a special, even sacramental, significance', and that there was 'no doubt whatever that the mass of this

material was deliberately thrown or placed in the hollows' (1965a, 7, 20). The identification of pattern and intention in these deposits accelerated and intensified with an increased tendency to see structure and symbolism in the ways in which the mass of artefacts, food remains and spent fuel, as well as obviously 'special' objects, were placed in the ground (e.g. J. Thomas 1999, 62–88).

The frequent presence of human remains, generally weathered and disarticulated, showed that the sites figured in mortuary rites, including excarnation. The possibility of cannibalism (Curwen 1954, 84) gave way to that of the circulation of defleshed bones between enclosures, long barrows and other contexts (Piggott 1962, 68). This line of thought culminated in Mercer's evocation of one of the uses of the main enclosure on Hambledon Hill. 'Was this enclosure one of the "elsewheres" where human corpses were exposed, the transient flesh allowed to deteriorate and ultimately disappear; this prior to a further occasional ceremony whereby some selected bones . . . were passed along an undoubtedly complex funerary *continuum* to encapsulation within a long barrow? . . . Little would have survived of the majority of bodies so disposed in the open, subject to wind, weather and worse . . . Occasionally dogs . . . would have gained access to the site to reap their grizzly harvest' (Mercer 1988, 95). Pictures like this fed a wider perception of the incorporation of ancestors into the affairs of the living (e.g. Barrett 1994, 50–5).

Humphrey Case (1982a, 2–5) used minimum community size, inferred from resource estimates for construction, as the basis of a system in which each enclosure was the nexus of the territory of a descent group composed of up to a dozen nuclear families, each with its own farmstead, and that of the leading family actually located in the enclosure. The territory would provide most of the essential resources, such as timber, antler, potting clay, pasture and arable, some of them extracted from temporary settlements away from the farmsteads, and others would be obtained by exchange with other groups. The accompanying diagrams include a river and a track: journeys within and beyond the territory in the course of the seasonal round would entail contact within and between kin groups, several of whom might come together at particular monuments or events.

Another all-encompassing interpretation, offered by Piggott (1954, 29–30) and expanded by Isobel Smith (1965a, 19), saw the enclosures as seasonal gathering-places for scattered, largely pastoral, populations, foci for the slaughter of cattle and for skin-dressing, but also for everything that such a population might undertake when assembled rather than dispersed: building the earthworks themselves, politics, ceremony, sacrifice, exchange, feasting, match-making and rites of passage. This picture enjoys a long and vigorous life, partly because it fits so much of the evidence from the enclosures themselves, with even the occasional violent episode matching the consideration that a scattered people can be attacked on any scale only when gathered, and partly because it fits so much of the evidence from beyond the enclosures, especially an abiding impression of a contemporary society made up of small, relatively mobile units (e.g. Whittle 1997a). There are loud echoes of Isobel Smith and Stuart Piggott in the more recent evocations of Mark Edmonds (1999, 106–8, 130–2), Francis Pryor (1998, 363–71) and others, not least in the suggestion that, at Windmill Hill, in Wiltshire, practically every dimension of early Neolithic existence was represented: the users' concept of and place in nature, their dealings with the dead, their remembered or mythical pasts, the value placed on live and dead animals, the social roles of feasting and sacrifice, and negotiation of position among and between communities (Whittle *et al*. 1999, 354, 381–90).

For many, if an enclosure was a focal point for a population then there was a connotation of authority. Colin Renfrew's identification of each causewayed enclosure in Wessex as the aggregation site for an emerging chiefdom (1973b) was presaged by Cecil Curwen's 'certain number of defended camps – perhaps tribal headquarters – belonging to the Neolithic period . . . the pottery found in them sometimes exhibits differences of type between one camp and the next, suggesting that communication between them must have been limited, and that pastoral nomadism must have been confined to the tribal area – perhaps as large as an English county' (1946, 55). For others, including Mark Edmonds (1999, 99), enclosures may have been arenas in which identity and authority came into being, rather than expressions of pre-existing authority.

Whatever its sociopolitical context, an enclosure has a relation to its catchment. When it comes to placing the sites within their human and physical landscapes, Isobel Smith was the first to point out that causewayed enclosures tend to lie across the contours rather than on hilltops, most of them being designed to face in a particular direction (1971, 92). The extensive analysis of Alastair Oswald and colleagues has elaborated and expanded this observation, proposing connections between enclosures and the areas to which they are 'tilted' and with which they are intervisible (Oswald *et al.* 2001, 91–106). Such a connection between an enclosure and a lower-lying area to one side meshes with persuasive molluscan evidence that, on the Sussex and Wessex Chalk, enclosures stood in woodland, peripheral to areas regularly occupied by people and their animals (K. Thomas 1982; Evans and Rouse 1991; Bell *et al.* 2008, 450). They were, in other words, part of a round which encompassed a larger landscape; 'What often gets missed is the sense of variety and change in the encounter that people had with these places. Visited periodically, many enclosures were points along the pathways that people trod with their animals. Founded on ecotones, sites like Knap Hill and Rybury sat on the threshold that separated seasons. They were between the lands of winter and summer and, even in more lowland settings, they were often marginal to the places in which people lived for much of the time' (Edmonds 1999, 92–3). Remoteness from the scenes of everyday life has suggested that enclosures may have been the scenes of potentially dangerous rituals, such as rites of passage, conducted in liminal, peripheral locations where the norms of everyday life may not have applied (Evans *et al.* 1988).

This and other interpretations share a tendency to generalise about enclosures, as if they and their uses were formed to a single mental template. Recognition of their diversity in form, size and history has followed from the progressive accumulation of information, viewed, from the 1980s onwards, from a more open, imaginative and creative theoretical standpoint. 'There are parallels between sites and they do seem to reflect the recognition of common ideas and the playing out of familiar themes. Yet . . . it is clear that these ideas were drawn upon rather differently from one time and place to another' (Edmonds 1999, 83). The chronology of the enclosures has largely also been viewed in a generalising way. Sequence and change have long been recognised, both in the use of individual earthworks, as in the introduction of dense, midden-like, deposits of artefacts and food remains into the upper, but not the lower, fills of the inner ditch at Maiden Castle in Dorset (Sharples 1991a, 50–1, 253–4), and in the modification and expansion of earthworks, as in the replacement of two multi-causewayed circuits at Crickley Hill with a single, more continuous, circuit (Dixon 1988a). Chris Evans drew such observations into a view of causewayed enclosures as ongoing projects, construction and reworking inherent parts of their use and purpose (1988b), suggesting that the vast but finds-poor Haddenham enclosure could reflect a very short-lived impetus to the massive collective effort necessary to build it and only rare, if any, subsequent gathering there (Evans and Hodder 2006, 333–7).

This inference of a short, circumscribed history was a rare one. The timescale and use-life of enclosures have generally been left vague and long. Even for examples with reasonably substantial series of radiocarbon dates, it could, in the late 20th century AD, be said only that Windmill Hill was built in the middle of the fourth millennium cal BC following pre-enclosure activity, with continued deposition in secondary ditch fills to the end of the fourth millennium or the beginning of the third millennium cal BC (Ambers and Housley 1999, 119–20); that the Maiden Castle enclosure was built between 3900 and 3700 cal BC and the long mound built over it by *c.* 3350 cal BC (Sharples 1991a, 104–5); and that Etton, in Cambridgeshire, fell within the expected range for British causewayed enclosures and may have been one of the earlier examples, with a span of some centuries for the original use of the site (Ambers 1998). Less still could be said of the others. Even at this stage, however, Russell's proposed fifth millennium cal BC origin for some of the Sussex enclosures (2001a, 114) seemed surprising. Their overall position in the early Neolithic has correspondingly been left undefined; furthermore, because later Neolithic and early Bronze Age material often occurs in the upper fills of causewayed enclosure ditches, they were thought to have been in continuous use into the third or even the second millennium cal BC.

The much shorter history of research on enclosures in Ireland is set out in Chapter 12.

1.4 The enclosures dating project

Context

The project was conceived in the early 2000s. It grew from two main sources.

First, there had been advances in the investigation of the monuments. The publication, actual or imminent, of excavations at Maiden Castle (Sharples 1991a), Eton Wick, Berkshire (Ford 1993), Combe Hill, East Sussex (Drewett 1994), Etton (Pryor 1998), Windmill Hill (Whittle *et al.* 1999), Raddon, Devon (Gent and Quinnell 1999b), Whitesheet Hill, Wiltshire (Rawlings *et al.* 2004), Great Wilbraham, Cambridgeshire (Evans *et al.* 2006), Haddenham (Evans and Hodder 2006), Hambledon Hill (Fig. 1.5; Mercer and Healy 2008), Magheraboy, Co. Sligo (Danaher 2007) and Donegore, Co. Antrim (Mallory *et al.* forthcoming) had vastly augmented the stock of detailed information about the enclosures and their use. These involved investigations at varying scales, including of much larger areas than before, closer stratigraphic observation and the application in most cases of finer recovery techniques. All this work brought into focus the diversity in size, layout, complexity, construction methods, contained activities, intensity of re-working and intensity of deposition – the last two perhaps proxies for duration of use – and thus called for new interpretations of the phenomenon. At a national level, survey of the entire monument class (Oswald *et al.* 2001) had recorded the sites in unprecedented detail; raised the total of certain or probable examples from over 50 in the 1980s (Darvill 1987, 59) to over 70 by the end of the 1990s (Fig. 1.2); reviewed previous readings of their roles and, most importantly, identified patterns in their topographic location. Their distribution had expanded north-westwards, although the southern concentration persisted (Figs 1.1–2, 1.4); there were now outliers to the regional groups identified by Rog Palmer (1976a); and the discovery of Donegore in the 1980s and of Magheraboy in the early 2000s had extended the distribution to Ireland. These advances again called for fresh interpretations, the more so as work on enclosures in Europe, summarised by Andersen (1997, 133–309), made it ever clearer that the British sites formed part of a wider network of shared traditions and practices, as already long recognised (Whittle 1977a; 1988a).

Parallel to these developments in research on Neolithic enclosures, there had been advances in radiocarbon dating. For individual measurements there had been progressive improvements in accuracy and precision (Bayliss 1998); it had become possible to obtain AMS dates from increasingly small samples, down to a single cereal grain or a gram of bone or antler (Dennell 1987); and well-replicated tree-ring calibration was now available for the entire period of this study (Reimer *et al.* 2004). At the same time, a means of reducing the still inherent imprecision of the method, through the application of Bayesian statistical modelling (Chapter 2; Bayliss *et al.* 2007a), had been developed (Buck *et al.* 1996) and, crucially, had become widely accessible through the availability of user-friendly computer software (Bronk Ramsey 1995; Buck *et al.*

1999). This methodology makes it possible to combine scientific dating evidence, such as radiocarbon dates, with other information about the samples and their contexts, such as the relative dating between contexts provided by stratigraphy. Thus, the probability distributions of individual calibrated radiocarbon dates can be constrained and we can estimate the dates of events that occurred in the past. An introduction to Bayesian chronological modelling is provided in Chapter 2.4 (and see also Buck *et al.* 1996; Bayliss 2007; Bayliss *et al.* 2007a).

A growing corpus of applications to single prehistoric sites, such as Stonehenge (Bayliss *et al.* 1997), the Drayton cursus (Bayliss *et al.* 2003a), the timber circle at Holme next the Sea (Bayliss *et al.* 1999), the Dover boat (Bayliss *et al.* 2003b), a burnt mound at Northwold (Crowson and Bayliss 1999) and the Iron Age cemetery at Yarnton (Hey *et al.* 1998), had all demonstrated that it was possible to establish precise construction dates and durations routinely. Applications in later periods, such as those at Tintagel (Bayliss and Harry 1997) and Buttermarket, Ipswich (Scull and Bayliss 1999), had demonstrated the potential for precision at a resolution which allowed comparison with historical evidence. Above all, the dating of Hambledon Hill (Bayliss *et al.* 2008a) demonstrated the potential for revealing sequences, the intervals between events within sequences, and even something of the pace of change.

At a national level, the modelling of dates for particular kinds of artefact or monument was beginning to show that, for example, the successive metalworking phases of the middle and late Bronze Age almost all started earlier than anticipated and that the transition from one to the next was brief (Needham *et al.* 1997), or that the construction of even a few long barrows was spread over some three centuries and that the initial use of each was much shorter than previously envisaged (Whittle *et al.* 2007a). These and other modelling exercises employed not only radiocarbon dates measured as part of these studies, but others from the pool of reliable dates that was accumulating faster than ever before (Bayliss 2009, figs 1 and 2). This body of data makes comparative studies increasingly feasible.

Aims

The project set out to build on these developments in the study of causewayed enclosures and in our ability to date archaeological sites precisely, by refining the dating of the enclosures themselves. As the project was formulated, it was unclear how far the start date of the Hambledon Hill complex in *3685–3640 cal BC* and its history of modification and initial use lasting *310–370 years* (both at *95% probability*; Figs 4.14, 4.16) were typical or exceptional. The questions formulated at the start of the project, around which our sampling strategies were built, were thus the following:

- When did causewayed enclosures begin to be built in Britain and Ireland?
- Did all of them begin to be built at the same time?
- How quickly was each built?
- Was it possible to see in detail, even at a generational timescale, how their use developed and changed through time?
- To what extent was their use continuous and to what extent episodic?
- Were they all used for the same length of time?
- What would better dating of causewayed enclosures contribute to a firmer understanding of the initial development of the British and Irish Neolithic?

1.5 Beyond the enclosures

To consider the last of these questions entailed defining the chronology of the rest of the early Neolithic. Several enclosures formed part of larger monument complexes, the varying trajectories of which have been repeatedly interpreted as reflections of forces at work within the societies which built and used them (e.g. J. Thomas 1999, 163–220), but it remained unclear whether they were the ‘founder monuments’ of those complexes and which other elements would have been in use with them. Even where other monuments in a complex were undated or imprecisely dated, dating the enclosures would pave the way to defining their local status in the future. Instances include the roles of Windmill Hill in the Avebury area, of Robin Hood’s Ball in the Stonehenge area, of Maiden Castle in the Dorchester area, of Etton in the Maxey complex and of Abingdon in the Barrow Hills complex.

In or out of larger complexes, enclosures are only a part of the wider process of the emergence of monument building and use. Approaches to monumentality in general have been at least as diverse as those to enclosures. A tradition of morphological analysis tending to typological classification, the definition of relationships, both national and European, and the establishment of sequences has had many practitioners, from Grimes (1936) and Daniel (1950), through Kinnes (1979a; 1992), to Darvill (2004a). Darvill is among the most recent of those to identify as potentially early elements of the insular Neolithic the circular stone monuments over or around which some long cairns were built (2004a, 68–71). A parallel, though younger, tradition of viewing monuments from the perspective of human experience emphasises their roles as performative arenas, as framers and guiders of movement, as distillations of accumulated memories and understandings, and as both meshed into and modifying the natural landscape (e.g. R. Bradley 1993; 1998a; 2000). The possibility of otherwise unattainable sensory effects, especially in enclosed spaces (e.g. Watson 2006), adds a further dimension to the experience of monuments.

Monuments attract attention because they are conspicuous. They occupy, however, only a small fraction of the terrain used by the early Neolithic population and they seem to have been favoured unevenly across regions, not least in the case of causewayed enclosures (Fig. 1.2). The inconspicuous traces of living, whether deliberately buried in pits, preserved in palaeosols or, most frequently, surviving only as lithic scatters, form a more evenly distributed and

preserved body of evidence, which has so far been analysed and interpreted more effectively at a local or regional level than at a national one (e.g. Holgate 1988a; Edmonds *et al.* 1999; Gardiner 1991). A tendency for early Neolithic artefacts to occur in smaller clusters than those of earlier and later periods (Edmonds 1995, 35) accords with the inference of small, mobile groups mentioned above.

Across Britain, the pattern and pace of the emergence of an insular Neolithic remained as unclear as its precise chronology. Although the probability of a pre-monumental Neolithic (perhaps little visible) has long been entertained (e.g. Case 1969, 180–1), once new beliefs and practices had been taken up, the early Neolithic has tended to be seen as a long-lasting and little changing set of lifeways in which monumental and artefactual traditions remained constant through the earlier part of the fourth millennium cal BC. During these centuries the same funerary monuments, whether earthen long barrows or stone-built chambers, were seen to have been used and elaborated by successive generations who also gathered repeatedly at causewayed enclosures, contributing to an ever-growing accumulation of cultural material in their ditches and sometimes expanding the enclosures themselves. Parallel to this, and often away from the monuments, small deposits of cultural material were placed in pits, rare rectangular houses were built, cereals were cultivated and domestic stock reared – the last two to a debatable extent (e.g. G. Jones 2000; J. Thomas 1999).

Many previous syntheses and accounts have operated within a very coarse chronology. One example is the definition of an Early Neolithic running from '*c.* 4000–34/3300 BC' (Whittle 1999, 59), though this is noted as not doing 'full justice to the regional patterns of landscape and subsistence change across the country, nor to artefact- or site-specific sequences' (Whittle 1999, 60). A more fluid and dynamic picture was painted by Edmonds, though few specific dates were suggested (1999). More recently, Richard Bradley has drawn on the emergent new dating to suggest a fairly rapid transition from earlier beliefs and practices and to stagger the emergence and cessation of different features in the 'early' insular Neolithic, pointing out that causewayed enclosures are not primary elements (2007, 27–87).

More detailed schemes have been proposed. Ian Kinnes' seriation of the grave goods from British Neolithic round barrows yielded a six-stage sequence spanning the fourth and third millennia cal BC (1979a, figs 6.1–8.1) in which 'radiocarbon dates have been used with caution…They are overall too few in number to be of real value, and further hesitation is invoked by the fact that single determinations often derive from long-lived multi-phase sites' (1979a, 49). In the twenty-first century, a many times-larger stock of radiocarbon dates took a fundamental rather than a peripheral role in detailed schemes for the Neolithic, including Alistair Barclay's for the Upper Thames catchment (2000; 2007, 332–5), Rick Peterson's for Wales (2003, 133) and Rosamund Cleal's, based primarily on the evidence from Wessex and the South-West but also on that of Britain as a whole (2004, 180–2). They differ in detail rather than in essence, so that one may serve as an example. Cleal's is made up of a low-visibility, possibly aceramic, earliest or contact Neolithic, *c.* ?4100–3850 cal BC; an early or developing Neolithic *c.* 3850–3650 cal BC, during which largely undecorated pottery, including Carinated Bowl, was made and used, long mounds began to be built and flint-mining was initiated if it was not already practised in the preceding period; and a 'high' or developed Neolithic, *c.* 3650–3350 cal BC, during which causewayed enclosures were built, other features of the 'classic' early Neolithic, including various Decorated Bowl styles, were most fully developed and, towards the end, Peterborough and Impressed Wares began to develop. A pattern seemed to be emerging, but, since all three schemes were based on evaluation (more critical in some cases than others) of available radiocarbon dates without statistical modelling, the task of quantifying the relationship of the enclosures to the rest of the 'early' Neolithic record still remained.

Precise chronology is also a prerequisite for any attempt to define the European roots of the insular Neolithic. It has long been recognised as self-evident that the ultimately south-west Asian practice of rearing domesticated animals and raising crops was introduced to Britain from the continent, as were monument-building, pottery-making and other artefactual innovations, whether independently or as a 'package'. Debate has centred on the processes by which this occurred, whether they were rapid or long-drawn-out, the areas of the continent involved in the contact and the balance between an influential incoming population and a receptive indigenous one. Here too intellectual fashion has fluctuated. There has been a long-lived tendency to seek specific source areas, following in the footsteps of Gordon Childe (1931), Jacquetta Hawkes (1934; 1935; 1938), Stuart Piggott (1955), Humphrey Case (1969) and Alasdair Whittle (1977b). For all these authors, the insular early Neolithic was eclectic in its European references so that source areas, if they existed, must have been plural.

The current major proponent of this tradition is Alison Sheridan, who sees distinct continental strands in the Neolithisation of Britain and Ireland (Pailler and Sheridan 2009; Sheridan 2003a; 2004; 2005; 2007a; 2010). These, in her view, began with an unsuccessful introduction of cattle into Ireland, probably from western France, in the second half of the fifth millennium cal BC, via an Atlantic route, represented by the animal(s) eaten at Ferriter's Cove, Co. Kerry (Sheridan 2003a; Tresset 2003). In the late fifth millennium cal BC there was, she argues, a movement of people from the Morbihan via an Atlantic and Irish Sea route along the coasts of Wales, western Scotland and northern Ireland, reflected in the construction of simple passage tombs and closed megalithic chambers and in parallels between pottery from a tomb at Achnacreebeag in Argyll and the Castellic II style of Brittany and Normandy (Sheridan 2003a). In the very early fourth millennium, a package of traditions is seen as introduced contemporaneously into southern, eastern and northern Britain from northern France: plant and animal domesticates; Carinated Bowl pottery; the construction of

long mounds, rectangular wooden buildings and perhaps enclosures; the transport and exchange of axeheads from remote sources; and the mining of flint (Sheridan 2007a; 2010; Pailler and Sheridan 2009). In the early part of the fourth millennium cal BC, contacts between Normandy and Brittany on the one hand and, the South-West peninsula and the Severn-Cotswold region on the other are seen in some simple passage tombs, the rotundae underlying some long cairns, and in the association of the Broadsands tomb, in Devon, with sherds of two Carinated Bowls (Sheridan *et al.* 2008). It is noteworthy that both the Michelsberg culture (the favoured source for Sheridan's Carinated Bowl Neolithic) and parallels between shouldered pots with concentric arc decoration from tombs in Brittany and the west of Scotland have been players on this stage at least since Childe, who in the latter case drew attention to pots from Beacharra (1931, pls IV, VII).

In the 1980s and 1990s many British prehistorians favoured a very different scenario, modelled on the better-documented transitions of Scandinavia and the Netherlands (and see Chapter 15). The indigenous Mesolithic population, often seen as having superior seafaring skills to neighbouring farming populations, was viewed as adopting, probably rather slowly, selected elements of Neolithic culture, with little influx of population and with a long survival of hunter-gatherer lifeways in the form of mobility, substantial reliance on wild plant foods and continued use of Mesolithic living sites (e.g. Zvelebil and Rowley-Conwy 1984; 1986; J. Thomas 1991, 15–17). This model was married largely to the southern English record and it has been urged that it does not fit the Irish evidence, especially in its assumption of a high level of settlement mobility and of relatively insignificant cereal cultivation (e.g. among others: Cooney 2000a; 2003; Monk 2000).

The gradualism of this model, still present in Cleal's contact Neolithic, has been challenged as much as its indigenism. By the start of the twenty-first century, Peter Rowley-Conwy could claim (2004) that it was increasingly apparent that, in Britain, Ireland and Scandinavia, Neolithic people subsisted mainly on cultivated plants and domestic animals and were fully sedentary, and that the transition to agriculture was rapid and probably traumatic. Within the narrower compass of southern Britain, Rick Schulting could propose that 'the adoption of "Neolithic" traits was for the most part an all-or-nothing affair in Britain, perhaps forming part of a sociopolitical and/or economic strategy wherein piecemeal adoption did not make sense' (2000, 33). This was prompted by an increasing perception that there might have been only a short interval between the latest use of microlithic armature in gatherer-hunter contexts and the earliest presence of Neolithic traits. Microlith manufacture and use had persisted into the very late fifth millennium cal BC not only in areas that could be seen as marginal, like March Hill on the Pennines (Spikins 2002, 43) but on the Wessex Chalk in the Fir Tree Field shaft in Dorset (Chapter 4; French *et al.* 2007, 282–5) and on the south Welsh coast at Lydstep Haven, Pembrokeshire (Leach 1918; Jacobi 1980, 175; David and Walker 2004); while an early Neolithic presence in the form of the Post and Sweet Tracks and their associated artefacts in the Somerset Levels was securely (dendrochronologically) dated to the end of the 39th century BC (Chapter 4; Coles and Coles 1986; Hillam *et al.* 1990), and occurrences elsewhere might be rather earlier, although their dating was far from watertight, mainly because of the presence of already old charcoal in radiocarbon samples (cf. Cleal 2004, 186–8).

Disjuncture at this time in Scotland, including an upsurge in contact across the Irish Sea and in interest in the remote and the exotic, seemed so great to Graeme Warren as to suggest a renegotiation and restatement of identity at a time of contact with immigrants, however few (2004). In a different reaction to the same body of evidence, Patrick Ashmore applied models derived from the analysis of present-day social networks to explain the apparent speed with which Neolithic practices spread across Scotland, proposing a fifth millennium cal BC indigenous population for at least some of whom distance and the time taken to travel it were negligible costs, leading to a high degree of connectivity between widely-spaced groups by means of relatively few long-distance journeys (2003, 43–6).

A signal change in the early fourth millennium cal BC emerged in the form of stable isotope evidence for the replacement of marine proteins by terrestrial ones in human diet, even in coastal areas (Richards and Hedges 1999; Richards *et al.* 2003; Schulting and Richards 2000; 2002a; 2002b), although there is disagreement about the speed and extent of this dietary transformation (e.g. R. Hedges 2004; Milner *et al.* 2004). Schulting (2004) related this to a social context in which cattle were becoming so important a currency as to provide compelling reason for wholesale adoption of the beliefs and practices of which cattle-keeping formed a part, a process accelerated by the impact of herding on human routines and the ecology of wild game.

The indigenism of the Scandinavian/Dutch model remains strong. It is difficult to imagine large-scale immigration in the context of the time; it is difficult to imagine how the indigenous population could have been eliminated; and it is significant that, while new finished lithic artefact forms were adopted, the traditional, indigenous flint-working technology persisted (Gardiner 1984, 17–19; Healy and Jacobi 1984; Holgate 1988a, 111, 132; Jacobi 1982, 21–2; Pitts and Jacobi 1979, 171–3) and that both late Mesolithic and early Neolithic lithics are often found in the same areas, even at the same locations, in regions as diverse and as widely separated as the East Anglian Fens (Hall and Coles 1994, 37, 41; Healy 1991, 132–5), the upper Thames catchment (Holgate 1988a, fig. 6.9), the Wear valley, Co. Durham (Young 1987, 32–6) and the Milfield Basin, Northumberland (Waddington 1999, figs 5.3, 6.3, appendix 6). In these circumstances, it is easy to see a persistence of traditional routines, including the seasonal rhythms of movement developed by previous generations (Edmonds *et al.* 1999, 74). Historical continuity may have been at least as significant as cultural disjuncture in this period (Harding and Healy 2007, 45–6).

Julian Thomas, having abandoned gradualism for the inception of the British Neolithic, although not for its subsequent development, proposed that 'the inception of the Neolithic period in Britain involved the sudden and synchronous appearance of a new cultural repertoire, including monuments, portable artefacts, and domesticated plants and animals. Not all of these have direct continental parallels, implying that the process involved inventiveness and *bricolage* on the part of the indigenous population' (2003, 73); and later that 'the only way in which we can make sense of the evidence is by assuming that the indigenous Mesolithic populations had a dynamic role in the formation of the British Neolithic . . . the introduction of the Neolithic into a new set of social and ecological conditions required that it should be reconstituted, and this reconstitution involved an interaction between Mesolithic and Neolithic communities. The sudden appearance of the Neolithic in Britain was a consequence of its having taken on a character that could be readily assimilated by local groups' (J. Thomas 2007a, 427). Thomas (2007a, 429) and others (e.g. R. Bradley 1993, 16–17; Hodder 1990; Whittle 1996, 370–1) emphasise in different ways that the material transformations must have been the manifestations of new beliefs and values, entailing altered attitudes to the natural world. Both ideological and material transformations required contact. The debate over immigrant and indigenous elements in the early British Neolithic is not between alternatives, but is a question of the degree and manner in which each contributed (Whittle 2007a, 390–4).

While uptake was clearly faster than many had previously believed, its assumed suddenness and synchroneity were impressionistic, built from the mass of accumulating radiocarbon dates, sometimes without adequate evaluation of individual measurements – despite the strictures of Waterbolk (1971) and Kinnes and Thorpe (1986) – and always without statistical modelling. The timescale of uptake, both of individual elements and in different regions, needed to be examined and its better definition could shed light on the human processes involved, the pace of change, and the relation between early conditions and the situations in which causewayed enclosures could be proposed as emerging.

1.6 This volume

Structure

The core of this monograph is formed by Chapters 3–12, each of which deals with the enclosures of a British region or, in the case of Chapter 12, the whole of Ireland, and places them in the context of the local evidence for early Neolithic activity. This exercise combines two unequal datasets. Radiocarbon dates from the enclosures are made up, in approximately equal parts, of measurements obtained in the course of this project for samples selected on the criteria described in Chapter 2 and of a range of measurements from a miscellany of sources for samples selected on widely varying criteria. The remainder of the dating falls entirely in the second category and derives from the chance of what happened to be available when the chapters were written. The resulting regional stories are thus based on foundations of variable soundness and strength and should be viewed as preliminary sketches which point the way to more focussed investigations.

The regions covered in the detailed chapters were determined by the presence of excavated and datable enclosures and are thus rather arbitrary in their boundaries and confined to southern Britain and Ireland. They do not include those parts of southern Britain which lack excavated enclosures or lacked them during the course of the project, among them Berkshire, Hampshire and Somerset. Chapter 13 reports stable isotope analysis of human and animal bone samples from some of the dated enclosures in the south of England. Chapter 14 combines the regional models to provide narratives for the date, duration and character of the enclosures and for other forms of early Neolithic activity, reviewing also a substantial sample of the Scottish evidence south of the Great Glen, and culminating in a preliminary attempt at the wider task of constructing reliable chronologies and interpretive narratives for the early Neolithic of Britain and Ireland as a whole. Chapter 15 discusses the many implications of these narratives, including the continental context.

Terminology and conventions

In the text, the repeatedly used terms 'generation' and 'lifespan' are taken respectively as 25 and 70 years (cf. Whittle *et al.* 2007a, 131–2; and see Chapter 15.13).

Following international convention (Mook 1986), radiocarbon ages are cited as 'BP', dates 'cal BC' or 'cal AD' are calibrated radiocarbon ages, and dates 'BC' or 'AD' are actual or estimated dates on the calendar scale (such as those derived from dendrochronology or input into simulation models). Dates '*cal BC*' or *'cal AD' in italics* are posterior density estimates derived from Bayesian modeling. All calibrated radiocarbon dates or posterior density estimates are followed by their identifying distribution name (often, but not necessarily, a laboratory number) and, if appropriate, the number of the figure on which the distribution is shown. On the figures, posterior density estimates are shown black and probability distributions derived from scientific dating alone are shown in outline. Further details of the terminology used in this volume can be found in Chapter 2.

Note

1 Though some ground stone axes were already used in parts of western Britain and in Ireland.

2 Towards generational time-scales: the quantitative interpretation of archaeological chronologies

Alex Bayliss, Johannes van der Plicht, Christopher Bronk Ramsey, Gerry McCormac, Frances Healy and Alasdair Whittle

The origins of this project lie in the first years of the 21st century AD. Bayesian approaches to modelling archaeological chronologies had been around for a decade or so (Naylor and Smith 1988; Buck *et al*. 1991; 1992; 1996), and were beginning to transfer into routine archaeological practice in Britain and beyond (Bronk Ramsey 1995; Buck *et al.* 1999; Bayliss and Bronk Ramsey 2004). By this time English Heritage had undertaken around 150 dating programmes using this new methodology. These site-based studies produced robust chronologies, often of much higher precision than had previously been possible (e.g. Bayliss and Harry 1997; Bayliss *et al.* 1996; 1997; 1999; Hey *et al.* 1998; Crowson and Bayliss 1999; Scull and Bayliss 1999). But, in the absence of a corpus of sites dated to a similar resolution, these applications were fundamentally lacking. Site-specific questions of sequence and tempo could be resolved, but lacking comparative evidence of a similar resolution these sites stood as isolated beacons in a wine-dark sea.

In the late 1990s, as part of an English Heritage-funded project to publish the extensive excavations which had taken place on the early Neolithic monument complex at Hambledon Hill, Dorset, during the 1970s and 1980s, a number of us were invited by the excavator, Roger Mercer, to collaborate on a major dating programme for the site (Bayliss *et al.* 2008a). This was undertaken in a Bayesian framework, with samples selected using simulation to make most effective use of the available stratigraphic information. The results of this dating programme (summarised in Chapter 4.1 and especially Fig. 4.14) – which produced a generational narrative for the development and use of the complex – perhaps gave us the first indication that a new kind of prehistory could emerge if dating of this resolution were to be available everywhere.

Consequently, a major impetus for this project was to provide an exemplar of the methodology, first, to illustrate the potential for using radiocarbon dating and Bayesian chronological modelling to produce precise chronologies routinely, and secondly, to explain and demonstrate the technical complexities which have to be addressed if such chronologies are to be constructed in practice. And, most importantly, to demonstrate what difference these chronologies make to the types of prehistory that we can write. As David Clarke (1973, 10) remarked more than a generation ago, 'the *consequences* arising from the introduction of new methodologies are of far greater significance than the new introductions themselves'.

So, this book proposes a new narrative for causewayed enclosures and the first centuries of the Neolithic in southern Britain and Ireland, but it also has a message for those devoted neither to the early Neolithic nor to *Ultima Thule*. Unlike dendrochronology, which is the preserve of the few fortunate enough to have the necessary structures and conditions of preservation, the methods set out in this chapter can be employed routinely by all archaeologists. You too can build chronological models for your site of the kind described in our regional chapters (Chapters 3–12; and see Bayliss and Whittle 2007; Bayliss 2009). You too can construct the types of narrative for your archaeology that we have set out in Chapter 14. You too can explore the kinds of prehistory that these narratives allow (see Chapter 15; Whittle *et al*. 2007a).

2.1 The radiocarbon dates

The tables in this volume provide full details of 2350 radiocarbon measurements. A total of 871 of these come from sites which were regarded as Neolithic enclosures at the start of this project (in fact 816 are from sites now regarded as Neolithic enclosures). We have obtained 427 new measurements, and reassessed 1923 existing measurements: 444 from enclosures and 1479 from other early Neolithic sites (Fig. 2.1). Of these radiocarbon dates, 1782 (76%) are incorporated in at least one of the Bayesian chronological models described in this volume.

Except for a few determinations made in the early years of radiocarbon dating before international conventions were established and which generally cannot now be recalculated (see below, section 2.6), all the radiocarbon measurements cited in this volume are conventional radiocarbon ages,

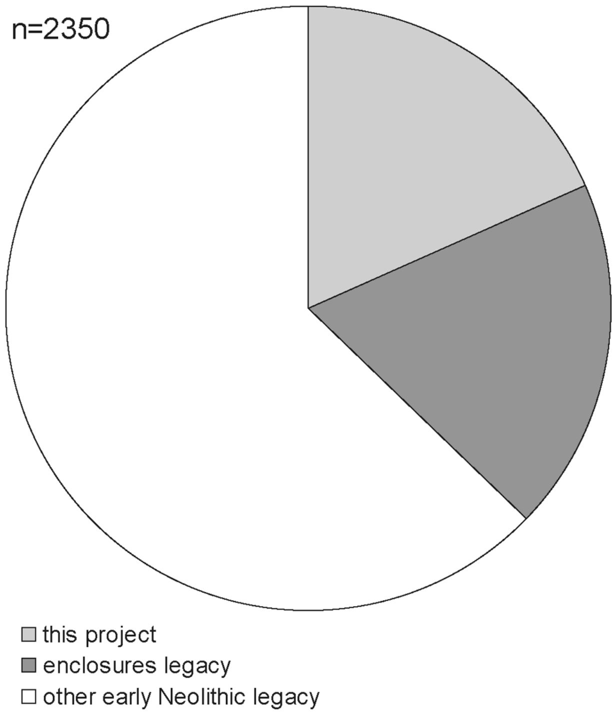


Fig. 2.1. Radiocarbon measurements discussed in this volume (n=2350).

corrected for fractionation (Stuiver and Polach 1977). Where replicate measurements have been made on the same sample, their consistency has been tested using the methods outlined by Ward and Wilson (1978), and if appropriate a weighted mean has been taken before calibration.

The calibrated date ranges provided in the tables and cited in the text have been calculated using the maximum intercept method (Stuiver and Reimer 1986) and the currently internationally agreed dataset for terrestrial samples from the northern hemisphere (Reimer *et al.* 2004). Date ranges are quoted in the form recommended by Mook (1986) with the end points rounded outwards to 10 years (or five years when error terms are less than ±25 BP). These calibrated date ranges are cited in normal type. A few marine samples have been calibrated using the currently internationally agreed dataset for the marine environment (Hughen *et al.* 2004) with local reservoir corrections as specified in the text (Stuiver and Braziunas 1993; Harkness 1983). Two samples of human bone from Ferriter's Cove, Co. Kerry (Table 12.10), which have strongly marine isotopic signatures, have been calibrated using a mixture of the terrestrial calibration curve and the marine dataset, again with an appropriate local ΔR correction (Bronk Ramsey 2001). The proportion of marine protein in each individual's diet has been estimated by linear interpolation based on the ranges of $\delta^{13}C$ values for terrestrial and marine food sources published by Mays (1998). A few measurements are regarded as inaccurate for reasons discussed in the text, and have not been calibrated.

Whilst it is hoped that readers will find these calibrations helpful, the intercept method itself is best regarded as a 'quick and simple' way of providing an indication of the calendar date of a sample. The full complexity of the calendar age is only apparent from the probability distribution of the calibrated date. These calibrations have been undertaken using the probability method (Stuiver and Reimer 1993). They are shown as black in the graphs, except where they form the 'standardised likelihoods' component of a Bayesian model (see below, section 2.3). In this case (the majority of graphs), they are shown in outline.

2.2 Scatter matters

Most prehistoric chronologies are derived from tables or graphs of simple calibrated radiocarbon dates. When faced with a graph such as Fig. 2.2, most archaeologists visually assess the area where most of the probability seems to lie, in this case interpreting the use of the enclosure perhaps as extending from *c.* 3780 cal BC to *c.* 3640 cal BC and lasting for perhaps 140 years. But in this graph the radiocarbon dates have been simulated (by a process of back-calibration[1]) from samples whose actual dates lie between 3700 and 3676 BC, and so span a period of only 25 years. Using this method of informally estimating chronology by visual inspection of calibrated radiocarbon dates, past activity will nearly always[2] be interpreted as starting earlier, ending later, and enduring for longer than was actually the case.

From this example, this may not seem to matter very much. Our point estimate for the date when the enclosure was built is 'only' 80 years wrong, and our assessment of the end date is 'only' 34 years wrong – and what is a generation or two on the scale of prehistory? But, in relation to a period of activity that actually only spanned 25 years, these estimates are between 150% and 300% wrong! Our estimate of duration is more than five times longer than it was in reality!

Consider, now, the second group of radiocarbon dates from the currency of a particular type of pottery (Fig. 2.3). Here visual inspection of the graph might suggest a date range of *c.* 3950–*c.* 3500 cal BC, a period of perhaps 450 years. Again, this is importantly misleading. In fact, these dates (simulated using the same procedure of back-calibration) actually run from 3860–3610 BC and span a period of 250 years. Once more, our date estimates are anomalously early, anomalously late, and our estimate of duration is far too long. But this time, with fewer dates spanning a longer period of activity, we are *proportionately* much less wrong.

This effect arises from the probabilistic nature of radiocarbon dating. Radiocarbon measurements themselves are estimates of the true radiocarbon content of a sample – ages therefore scatter around the true value in accordance with the, normally distributed, quoted error. This effect is often exacerbated by the process of radiocarbon calibration, when calibrated dates can also spread on to plateaux in the calibration curve adjacent to the true dates of the samples.

Unfortunately, our present understanding of the chronology of British and Irish prehistory largely derives from

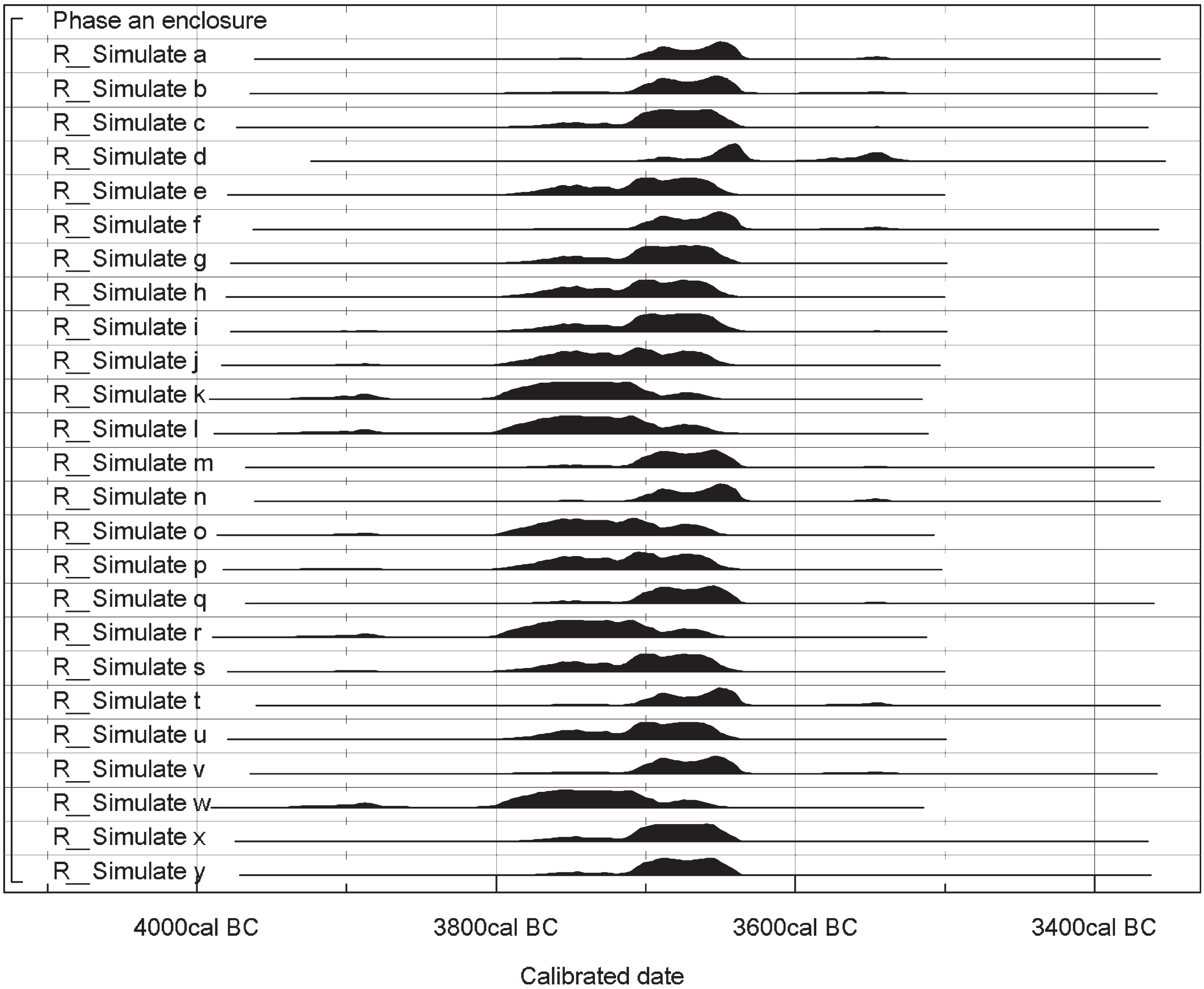


Fig. 2.2. Calibrated dates for 25 radiocarbon measurements simulated from samples which actually date to between 3700 and 3676 BC.

the informal interpretation of graphs or tables of calibrated radiocarbon dates by visual inspection. This approach demonstrably does not take into account the scatter on the radiocarbon dates, and leads to date estimates for archaeological activity that are, quite simply, wrong. As importantly, our estimates of the duration of activities in the past are also routinely too long. The consequences are a fuzzy prehistory which floats timelessly across centuries, and an impression of change playing out over similarly extended timescales.

It is this demonstrable inadequacy of informal methods which makes the utilisation of formal mathematical approaches for modelling chronology essential.

2.3 The Bayesian approach

The basic idea behind the Bayesian approach to the interpretation of data is encapsulated by Bayes' theorem (Bayes 1763; Fig. 2.4). This approach is fundamentally probabilistic and contextual. It simply means that we analyse the new data we have collected about a problem ('the standardised likelihoods') in the context of our existing experience and knowledge about that problem (our 'prior beliefs'). This enables us to arrive at a new understanding of the problem which incorporates both our existing knowledge and our new data (our 'posterior beliefs'). This is not the end of the matter, however, since today's posterior belief becomes tomorrow's prior belief, informing the collection of new data and their interpretation as the cycle repeats (Fig. 2.5). We do this by the use of formal probability theory, where all three elements of our model are expressed as probability density functions. An accessible general introduction to the principles of Bayesian statistics is provided by Lindley (1985).

In this volume we implement a Bayesian approach to modelling archaeological chronologies. This is an explicit, probabilistic method for estimating the dates when events happened in the past and for quantifying the uncertainties on these estimated dates. When constructing a Bayesian chronology, the calibrated radiocarbon dates form the 'standardised likelihoods' component of the model and archaeology provides the 'prior beliefs' (Fig. 2.4). This

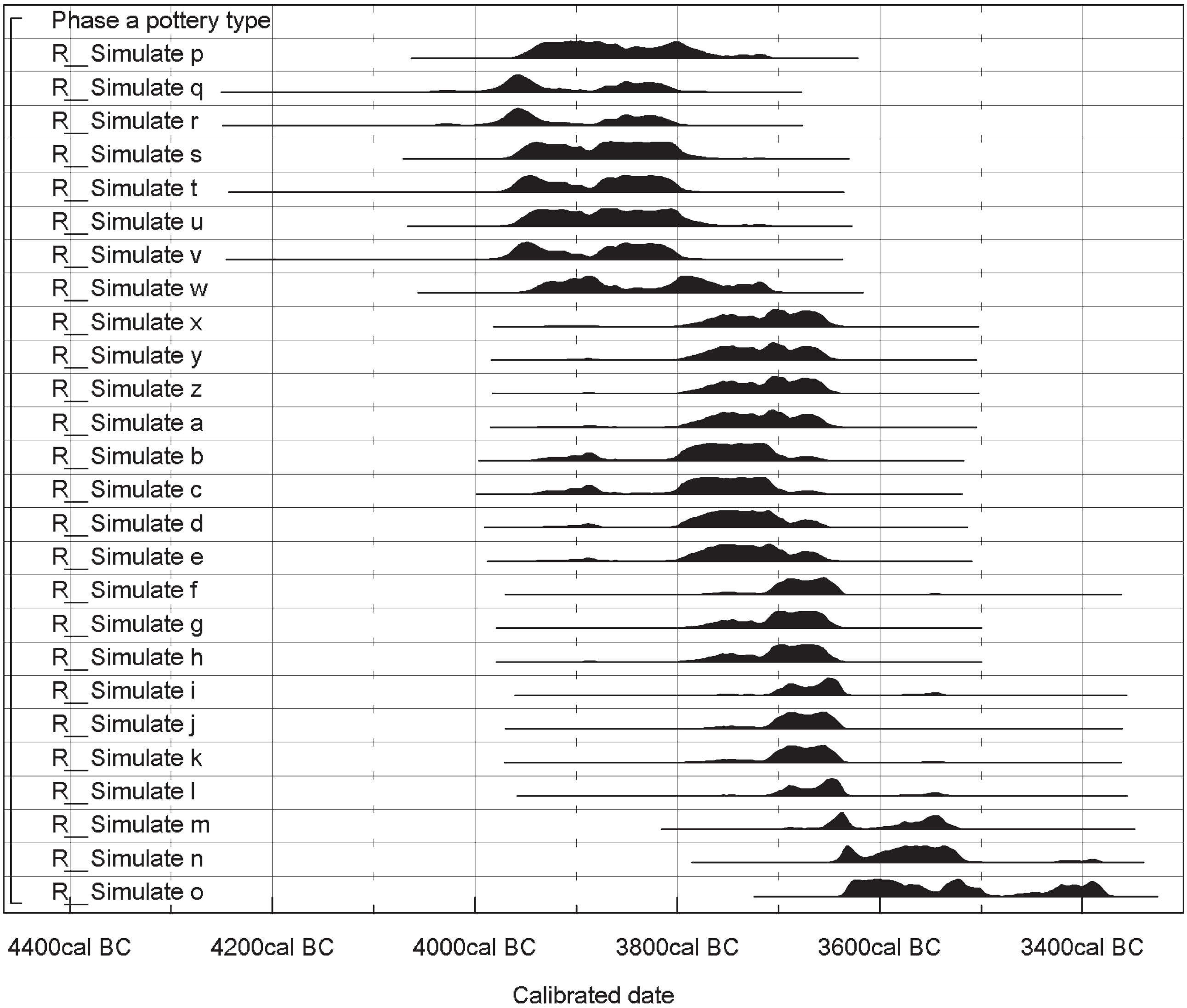


Fig. 2.3. Calibrated dates for 26 radiocarbon measurements simulated from samples which actually date to between 3860 and 3610 BC.

$$P(\text{parameters}|\text{data}) = P(\text{parameters}) \times \frac{P(\text{data}|\text{parameters})}{P(\text{data})}$$

$$\underbrace{\text{Posterior beliefs}}_{\text{‘an answer’}} = \underbrace{\text{Prior beliefs}}_{\text{‘the archaeology’}} \times \underbrace{\text{Standardised likelihoods}}_{\text{‘the dates’}}$$

Fig. 2.4. Bayes’ theorem.

means that the radiocarbon dates are reinterpreted in the light of the archaeological information, to provide posterior beliefs about the dates we are modelling. There is a conceptual shift here. Independent, scientific radiocarbon dates were once heralded as providing ‘good objective chronology’ (Renfrew 1973a, 109). Bayesian chronologies are different. They are contextual and interpretative. They can and will change as more radiocarbon dates are obtained and incorporated into our models, and as we choose to build our models in different ways. Sometimes, a group of radiocarbon dates may be modelled in different ways to answer different questions (compare, for example, the models for the long cairns defined in Figs 11.12–14, with the use of the same dates in the overall model for the early Neolithic in South Wales and the Marches defined in Figs 11.10–11). Indeed, the construction and comparison of alternative models (known as ‘sensitivity analyses’) are a fundamental part of the Bayesian process.

A general introduction to the application of the Bayesian approach to archaeological data is provided by Buck *et al.* (1996). More specific introductions to building Bayesian chronologies in archaeology are provided by Bayliss *et al.* (2007a) and Bayliss (2007). Details of the mathematical methods involved in chronological modelling can be found in a series of papers by Blaauw and Christen (2005), Bronk Ramsey (1995; 1998; 2000; 2001; 2008; 2009a; 2009b), Buck *et al.* (1991; 1992; 1994a; 1994b), Bronk Ramsey *et al.* (2001), Christen (1994), Christen and Litton (1995), Christen *et al.* (1995), and Nicholls and Jones (2001).

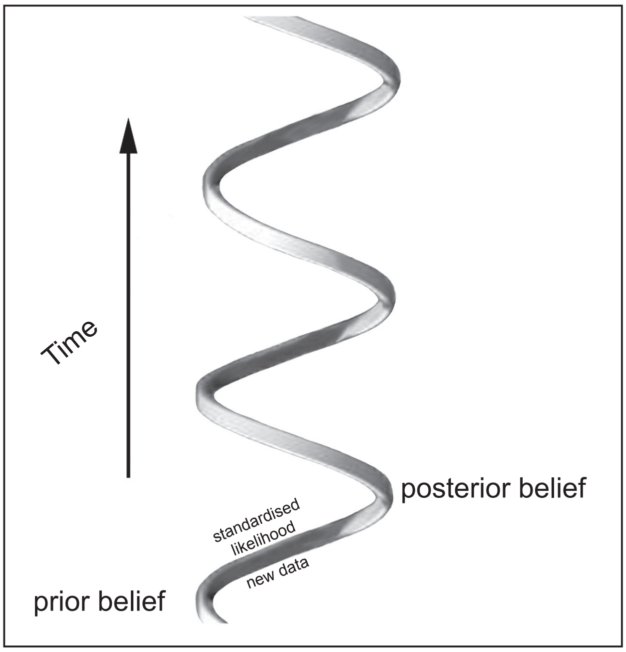


Fig. 2.5. Bayes' theorem and the hermeneutic spiral (after Hodder 1992, fig. 22). Drawing by Derek Hamilton.

2.4 An introduction to Bayesian chronological modelling

All the chronological modelling in this volume has been undertaken using the program OxCal v3.10 (Bronk Ramsey 1995; 1998; 2001). As described in the documentation and references relating to this program, each model is exactly defined by the sequence of brackets and keywords down the left-hand side of the diagrams. In this application, many models contain far too many standardised likelihoods for them to be defined in single diagrams. In these cases, one diagram defines the overall structure of the model, with its components defined in one or more additional graphs. Chapters 12 and 14 in particular contain many complex models of this kind, and prehistorians with limited experience of chronological modelling are strongly recommended to engage with at least one of the regional chapters before attempting to grapple with these more synthetic discussions.

Simple or complex, all Bayesian chronological models comprise two elements: standardised likelihoods and prior beliefs (Fig. 2.4). In practice, both of these come in a variety of archaeological forms.

2.4.1 'Uninformative' prior beliefs

Prior beliefs are no more than a formal, mathematical expression of our understanding of the archaeological context of the chronological problem we are modelling. Archaeologists are very good at prior beliefs. It is extremely unusual for us to know nothing at all about a set of samples. Unfortunately, however, archaeologists often do not realise how much they actually know about their samples and have difficulty in expressing this information in a form which can be incorporated into chronological models.

At the most simple extreme, consider the sets of calibrated radiocarbon dates shown in Figs 2.2–3. We may think that we know nothing about the context of these dates. But we do. We know that they are *related*. The dates in Fig. 2.2 come from an enclosure. The dates in Fig. 2.3 are all associated with a particular type of pottery. In each case, the dates sample a period of activity that happened in the past. This may not sound like very much, but even this prior information is extremely powerful.

It allows us to quantify the scatter on calibrated radiocarbon dates, which as we saw in section 2.2 above is a real issue in using them to interpret chronology. This is done by imposing a statistical distribution on the underlying, real period of activity in the past, of which our radiocarbon dates are a sample. This is illustrated in Fig. 2.6, where we have implemented a uniform distribution on the underlying sample of dated activity for the fictitious enclosure whose dates were illustrated in Fig. 2.2. This means that we assume that the occupation of the enclosure began, continued relatively constantly, and then ended (see below, section 2.8). This approach allows the model to assess how far the variation in the calibrated radiocarbon dates arises from variation in the actual dates of the samples, and how far from the probabilistic scatter inherent in radiocarbon dating and the calibration process.

In this diagram the calibrated radiocarbon dates, which form the standardised likelihoods for the Bayesian model, are shown in outline. The probability distributions in black are the posterior beliefs, or *posterior density estimates*. By convention, when these are expressed as date ranges they are given *in italics* to distinguish them clearly from simple calibrated radiocarbon dates. In this volume, all posterior density estimates have been rounded outwards to the nearest 5 years. Each calibrated radiocarbon date now has a revised probability distribution, a *posterior density estimate*. This revised probability distribution has been calculated by taking into account not only the radiocarbon content of the sampled material, but also the fact that each radiocarbon date is part of an assemblage of related dates associated with a period of past activity.

So, for example, the calibrated date for sample x is 3770–3630 cal BC (95% confidence), as a radiocarbon age of 4906±35 BP was simulated from the actual calendar date of this sample (3677 BC). This is the distribution shown in

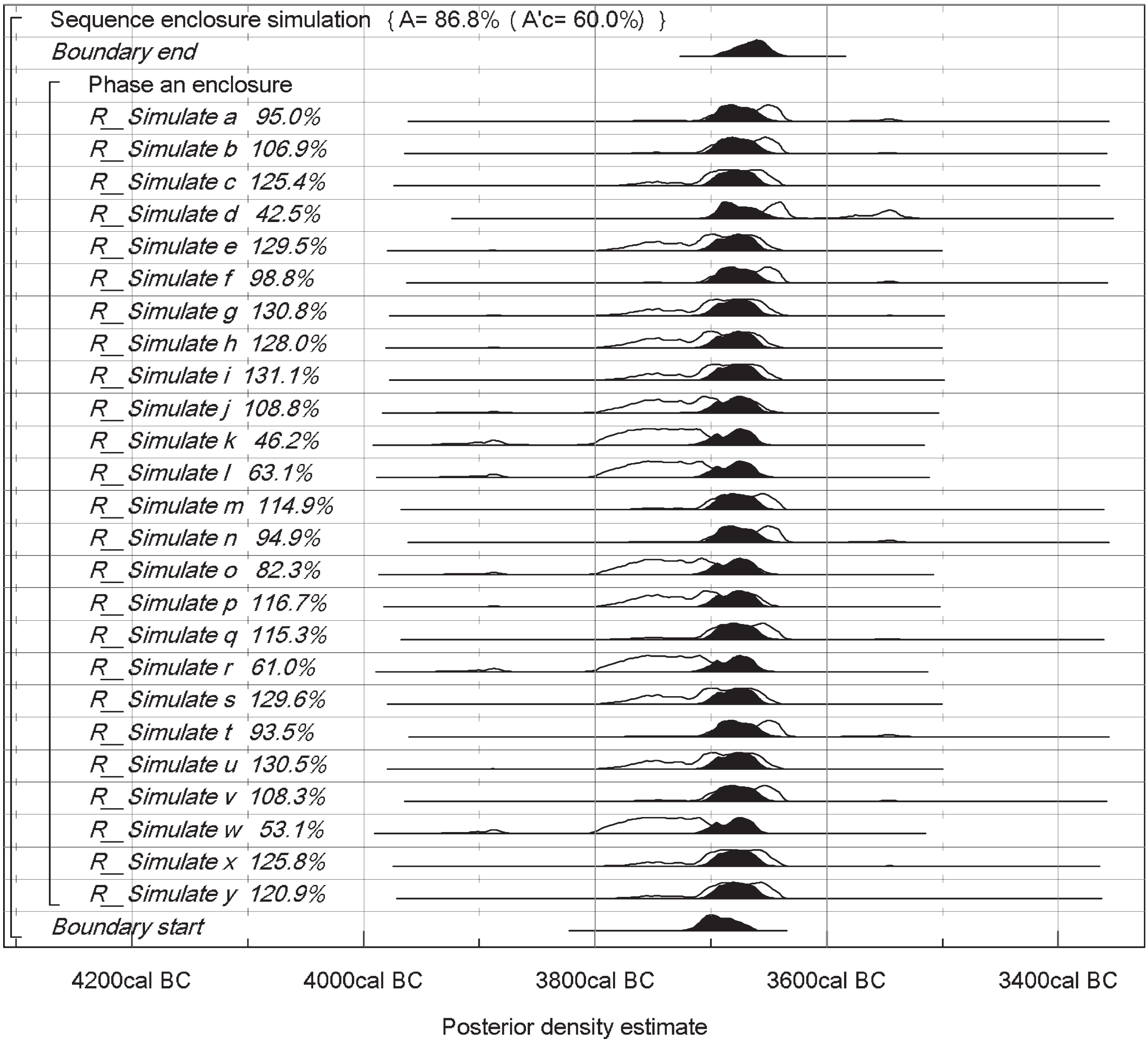


Fig. 2.6. Probability distributions of dates from a fictitious enclosure, incorporating a uniform distribution for the use of the site. The simulated dates are those shown in Fig. 2.2 (3700–3676 BC). Each distribution represents the relative probability that an event occurs at a particular time. For each radiocarbon date, two distributions have been plotted: one in outline which is the result of simple radiocarbon calibration, and a solid one based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution 'start' is the posterior density estimate for the time when the enclosure was constructed. The large square brackets down the left-hand side of the diagram and the OxCal keywords define the overall model exactly.

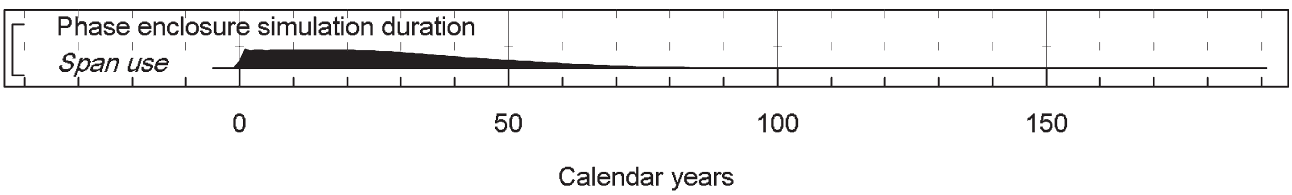


Fig. 2.7. Probability distribution of the number of years during which the fictitious enclosure was in use, derived from the model shown in Fig. 2.6.

outline in Fig. 2.6. The posterior density estimate for sample x is *3705–3655 cal BC* (*95% probability*; *x*), probably *3695–3660 cal BC* (*68% probability*). This is the probability distribution shown in black in Fig. 2.6. Note that '*x' in italics* refers to the probability distribution of the posterior density estimate, whereas 'x' in normal type refers to the radiocarbon age or the calibrated date. In this instance the known date of this sample (3677 BC) lies within the range

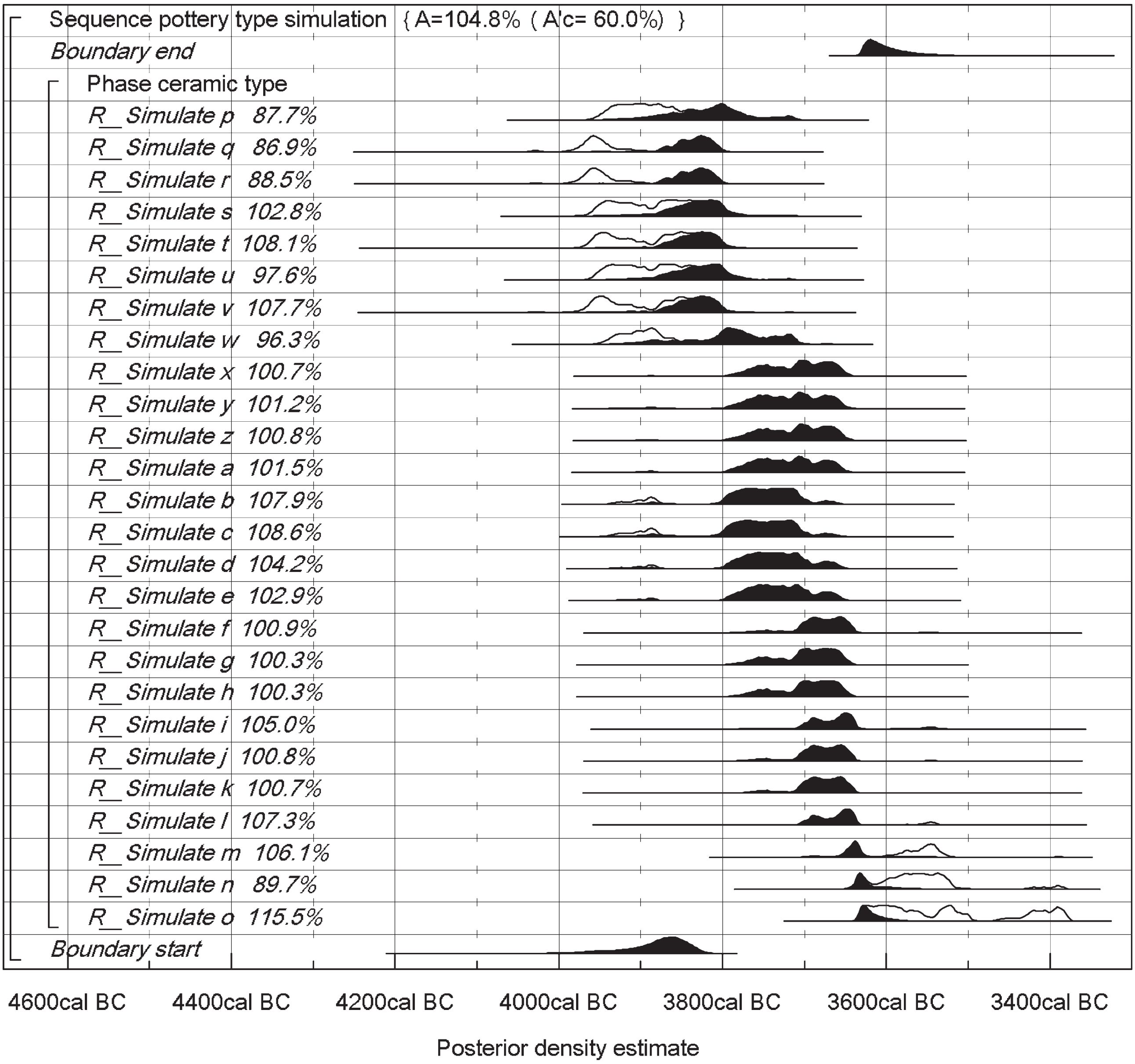


Fig. 2.8. Probability distributions of dates from a fictitious ceramic type, incorporating a uniform distribution for the currency of this pottery. The simulated dates are those shown in Fig. 2.3 (3860–3610 BC). The format is identical to that of Fig. 2.6. The large square brackets down the left-hand side of the diagram and the OxCal keywords define the overall model exactly.

of the calibrated date (at both 95% and 68% confidence), and also within the ranges of the posterior density estimate (at both *95% and 68% probability*). It is important to recognise this, probabilistic nature of both radiocarbon dating and Bayesian modelling. Our date estimates are just that – estimates, and the true dates of our samples will lie outside the 95% range once in every twenty cases, and outside the 68% range nearly once in every three. We will present formal date estimates for 38 Neolithic enclosures in this volume. Probability theory means that the true date of the construction of one or two of these enclosures will lie outside the 95% probability range of the relevant posterior density estimate, and that the true date of around a dozen enclosures will lie outside the 68% probability range of the relevant posterior density estimate.

In Fig. 2.6 not all the probability distributions shown map one-to-one with calibrated radiocarbon dates. There are additional probability distributions shown which do not. This is another difference between Bayesian chronologies and radiocarbon dating. These additional parameters estimate the dates when things happened in the past that are not directly sampled by radiocarbon dating. So, for example, the parameter '*start*' is the posterior density estimate for the date when our fictitious enclosure was established. This estimate is derived from all the radiocarbon dates in our sample, but account is also taken of the fact that it is extremely improbable that we have actually dated the first piece of datable material to be deposited on the site. We have in this case 25 radiocarbon measurements covering a period of 25 calendar years (in

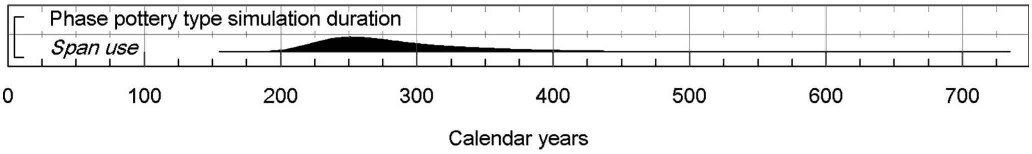


Fig. 2.9. Probability distribution of the number of years during which the fictitious ceramic type was in use, derived from the model shown in Fig. 2.8.

fact, such a high sampling density is probably rare in real archaeological applications). But there are almost certainly hundreds, if not thousands, of animal bones, charred cereal grains, fragments of charcoal and so on from our site, and so the probability that we have actually dated the first is tiny. By assessing the number of dates in our sample and the period of calendar time over which they scatter, the model can allow for this fact in estimating the date when activity on the site started.

The model shown in Fig. 2.6 does this. It estimates that our fictitious enclosure was established in *3720–3660 cal BC* (*95% probability*; Fig. 2.6: *start*), probably in *3710–3675 cal BC* (*68% probability*), and it ceased to be used in *3695–3640 cal BC* (*95% probability*; Fig. 2.6: *end*), probably in *3680–3650 cal BC* (*68% probability*). Again, in both cases the actual dates of these parameters (3700 BC and 3676 BC) fall comfortably within the posterior density estimates at both 95% and 68% probability. This example also illustrates another aspect of chronological models. By taking the difference between the probability distributions for the *start* and *end* of a period of activity, it is possible to estimate formally the duration of its *use*. This parameter is shown in Fig. 2.7. The period when the site was in use is estimated to have lasted *0–65 years* (*95% probability*; Fig. 2.7: *use*), probably *0–35 years* (*68% probability*). These estimates of duration are compatible with the actual span of the dates input into the simulation: 3700 – 3676 BC (25 years).[3]

In the example just discussed, and indeed for many of the enclosures and other sites whose dating is discussed in this volume (e.g. Windmill Hill and West Kennet, Chapter 3; Hambledon Hill and Maiden Castle, Chapter 4; Crickley Hill, Chapter 9), we are fortunate enough to have a sampling density that allows us to discuss past human activity at a scale of generations. Frequently, we are not so fortunate. Figure 2.8 shows a chronological model for the currency of the ceramic typology associated with the radiocarbon dates shown on Fig. 2.3. Again, we have imposed a uniform distribution on the underlying period of dated activity to allow for the relationships between the dated samples.

This model suggests that this pottery type began to appear in *3965–3820 cal BC* (*95% probability*; Fig. 2.8: *start*), probably in *3900–3835 cal BC* (*68% probability*). It fell out of favour and ceased to be deposited in *3635–3540 cal BC* (*95% probability*), probably in *3630–3590 cal BC* (*68% probability*). Again, the actual start and end dates (3860 BC and 3610 BC) fall comfortably within the relevant posterior density estimates for these dates suggested by the model. The actual duration (250 years) also falls within the estimates for the duration of this ceramic type provided by the model: *200–390 years* (*95% probability*; Fig. 2.9: *use*), probably *220–305 years* (*68% probability*).

In this example, we can no longer talk about generations. The resolution of our chronology is more at a scale of centuries or maximum lifetimes. This is the type of dating we have been able to achieve for many of the models that we have constructed for other elements of the early Neolithic in southern Britain and beyond to compare with our dating of enclosures (see especially Chapter 14). It is essential to recognise these different resolutions in our interpretations of these chronologies. The posterior density estimate for the start of our fictitious enclosure (Fig. 2.6: *start*) has a calendrical bandwidth of 60 years, while that for the start of our fictitious type of pottery (Fig. 2.8: *start*) has a calendrical bandwidth of 165 years. These are statements of our uncertainty about exactly when the first antler pick broke the turf to begin the construction of the enclosure or the first sherd identified as belonging to our fictitious type of pottery was deposited. Both these events in reality happened in one hour of one day in a particular year; we can just estimate the date of the construction enclosure more precisely than the date of the introduction of the pottery type.[4]

In the examples considered so far, we have had what are (for archaeology) reasonably dense sampling intervals – 25 radiocarbon dates spread over 25 calendar years in the example shown in Figs 2.2 and 2.6, and 26 radiocarbon dates spread over 250 calendar years in the example shown in Figs 2.3 and 2.8. But what happens when, for whatever reason, we have far fewer radiocarbon dates? Such a scenario is illustrated by the model shown in Fig. 2.10. In this model, we now only have seven radiocarbon dates spanning the 250-year period from 3860–3610 BC – one every 40 years or so.

This model suggests that the use of the fictitious ceramic type began in *4120–3810 cal BC* (*95% probability*; Fig. 2.10: *start*), probably in *3985–3835 cal BC* (*68% probability*), and that it ended in *3635–3385 cal BC* (*95% probability*; Fig. 2.10: *end*), probably in *3625–3510 cal BC* (*68% probability*). The posterior density estimates from this model do contain the true dates of these parameters (3860 and 3610 BC), but in both cases they lie at the inner extremes of the distributions. The long tails on posterior density estimates such as these arise because the model contains insufficient data to effectively assess, and counteract, the statistical scatter on the radiocarbon dates. This is why date estimates for parameters of this type which come from models containing many radiocarbon

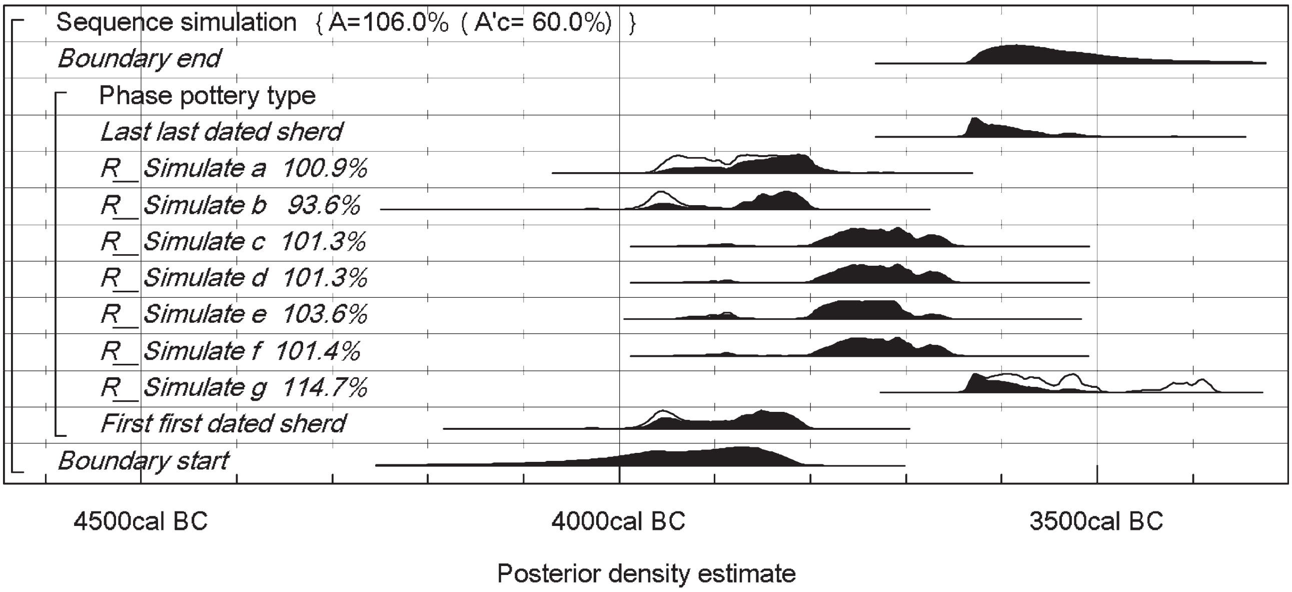


Fig. 2.10. Probability distributions of dates from a fictitious ceramic type, incorporating a uniform distribution for the currency of this pottery. Only seven dates have been simulated spanning the period 3860–3610 BC. The format is identical to that of Fig. 2.6. The large square brackets down the left-hand side of the diagram and the OxCal keywords define the overall model exactly.

dates (e.g. Fig. 9.7: *start Crickley Hill*) are routinely much more precise than those from models which contain fewer measurements (e.g. Fig. 9.18: *start Peak Camp*).

These formal, probabilistic estimates provide accurate assessments of the dates of activities in the past and provide realistic, quantitative estimates of our uncertainty on those estimates. Distributions with such long tails, however, can be archaeologically misleading, and so in such situations we have also calculated the first or last dated event in a group of measurements. These estimates are still constrained by the uniform distribution on the underlying period of activity, and so the effect of statistical scatter on the radiocarbon dates is still taken into account, but they do not attempt to estimate the dates when the site was in use, only the period spanned by the actual dated samples. In this example, the first dated sherd was deposited in *3970–3805 cal BC* (*95% probability*; Fig. 2.10: *first dated sherd*), probably *3965–3935 cal BC* (*13% probability*) or *3885–3810 cal BC* (*55% probability*). The last dated sherd was deposited in *3640–3515 cal BC* (*95% probability*; Fig. 2.10: *last dated sherd*), probably in *3635–3585 cal BC* (*68% probability*). This example is unusual because we have actually simulated dates from the first year and the last year of the period of activity in which we are interested. In reality, these parameters are usually slightly later or slightly earlier than the estimates for the start and end of activity respectively (see, for example, Fig. 9.32). This is as it should be. The first dated activity will always be slightly later than the actual date when a period of activity started, and the last dated activity will always be slightly earlier than the actual end of the activity. If, for example, we have dates from the base of a causewayed enclosure ditch, these are unlikely to date from long after its construction. In these circumstances, the first dated event in the enclosure appears to be a more realistic estimate for the date when the enclosure was constructed than a formal estimate for the start of the start of activity on the site that has an anomalously long tail of probability because we have insufficient data to address the real issue at hand.[5] In an ideal world, we would always have sufficient data to estimate the dates when a period of activity began and ended effectively, but in the absence of such data the first and last dated samples can act as a pragmatic proxy. We have used this approach, for example, in estimating the date when the outer ditch at Peak Camp, Gloucestershire, was excavated (Fig. 9.18: *build outer Peak Camp*). We must always be aware, however, that when we compare parameters such as these with formal estimates for the start of activity on a site, strictly we are not comparing like with like.

Figure 2.11 shows the estimate for the length of time the ceramic type dated by the model shown in Fig. 2.10 was current. This model estimates that this period lasted *210–650 years* (*95% probability*; Fig. 2.11: *use*), probably for *250–475 years* (*68% probability*). This distribution again has a long tail, in this case tailing towards a longer period of use. This is typical, and is particularly noticeable for sites which probably had a short duration but where the number of dates is insufficient to effectively demonstrate this (e.g. Whitesheet Hill, Chapter 4; Kingsborough 1 and 2, Chapter 7). In these cases, the distribution of the duration is usually skewed heavily towards zero.

This example also demonstrates that other calculations can be performed on the posterior density estimates output from Bayesian models. By taking the difference between the start and end of a period of activity, we can calculate the duration of the period (see above, Figs 2.7 and 2.9). But we can actually compare any two distributions and calculate

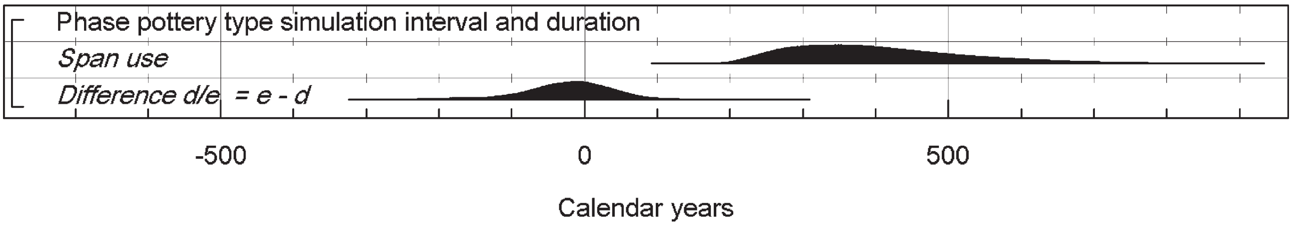


Fig. 2.11. Probability distributions of the number of years during which the fictitious ceramic type was in use and of the gap between samples d and e, derived from the model shown in Fig 2.10.

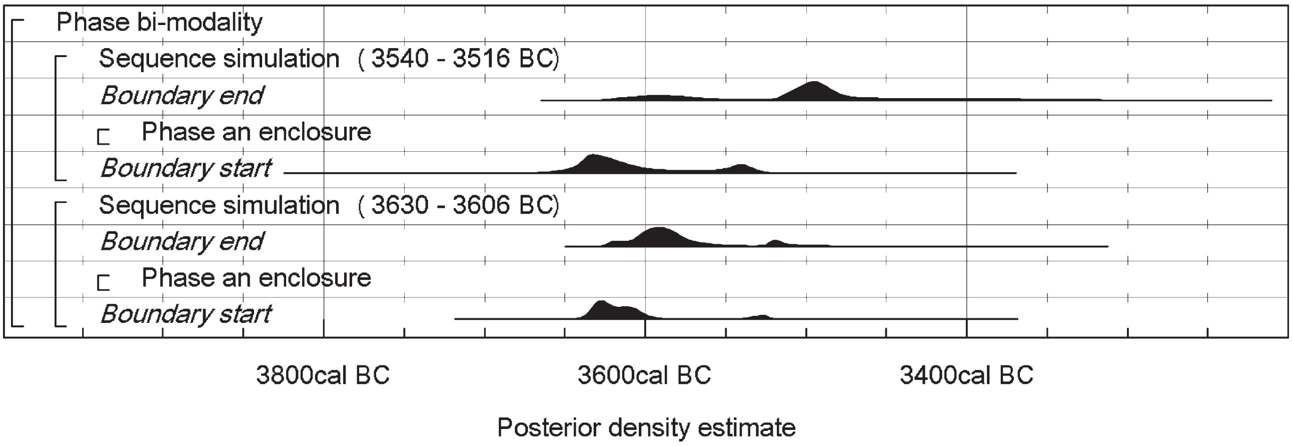


Fig. 2.12. Probability distributions of the estimated start dates of two fictitious enclosures, derived from models identical in form to Fig. 2.6 where the simulated dates span the periods 3630–3606 BC and 3540−3516 BC respectively.

the difference between them. For example, in Fig. 2.10 the probability that sample *d* was deposited before sample *e* is 37%.[6] The interval between the deposition of these two samples is shown in Fig. 2.11. The model estimates this interval to have been between *−195 years and 110 years* (*95% probability*; Fig. 2.11: *d/e*), probably between *−75 and 45 years* (*68% probability*). Because we do not know certainly which event came first, this distribution spans zero. So, this interval is positive when sample *e* is later than sample *d*, and negative when sample *d* is later than sample *e.* In this, it is unlike the durations of sites or periods where (logically) the beginning is constrained to come before the end! Distributions of this type are found, for example, in Chapter 8 where we consider the order of construction of the circuits of the Abingdon causewayed enclosure (Fig. 8.23).

So far most of the posterior density estimates discussed in this section have been conveniently unimodal. Because of wiggles in the radiocarbon calibration curve (see below, Fig. 2.17), this is by no means always the case. This is illustrated by the posterior density estimate for the *first dated sherd* in the previous example: *3970–3805 cal BC* (*95% probability*; Fig. 2.10: *first dated sherd*), probably *3965–3935 cal BC* (*13% probability*) or *3885–3810 cal BC* (*55% probability*). Here, the highest posterior density interval at 68% probability is split between two different ranges which together make up 68% probability. The significance of this effect for some of the enclosures dated in this study is shown in Fig. 2.12. This shows the *start* and *end* estimates calculated by models of the form shown in Fig. 2.6, but where the 25 simulated radiocarbon dates really span the periods 3630–3606 BC and 3540–3516 BC respectively. In both cases, the resultant posterior density estimates are strongly bimodal (Fig. 2.12), although in the earlier example the true dates fall on the earlier peak of the distribution and in the later one they fall on the later peak. In both cases the true dates of these parameters fall within the date ranges provided by the posterior density estimates at both 95% and 68% probability (although they do not necessarily fall on the higher peak of the distribution). Distributions of this type have been obtained for a number of sites in this study (the West Kennet long barrow, Chapter 3; St Osyth, Chapter 7; Abingdon, Chapter 8), and it should be remembered when interpreting these estimates that the true date of the site could fall on either peak of the distribution. In cases where the estimate of the duration, however, is short (e.g. West Kennet and St Osyth, but less certainly Abingdon), it appears that the true dates of these sites must lie either on the earlier peak of both the *start* and *end* estimates, or on the later peaks of both. We have been unable to reproduce this effect in a simulation which spans more than 25 calendar years in this period.

The type of archaeological prior information we have included in our models so far is known as 'uninformative' or 'vague' prior information. This is where we have little definite information about a problem, but where we need to include information to avoid biasing a model (see section 2.2

above; Steier and Rom 2000; Bronk Ramsey 2000; Bayliss *et al.* 2007a, 8–15). In chronological modelling these vague prior beliefs usually take the form of statistical distributions imposed on a group of related dates. In this volume, we have used a uniform distribution of the underlying activity (Buck *et al.* 1992; Nicholls and Jones 2001). This choice is discussed further in section 2.8 below.

2.4.2 'Informative' prior beliefs

Informative prior beliefs are the second type of archaeological information which can be incorporated into our chronological models. As the name suggests, this is where we have specific and definite information about a problem which should affect the outputs of a model substantively. It has long been recognised that 'the pattern of radiocarbon ages of samples, especially where there is stratigraphic control, is of greater significance than a single determination' (J.G.D. Clark 1994, 122), and in modelling archaeological chronologies, informative prior beliefs usually derive from the relative dating evidence provided by stratigraphic relationships between radiocarbon samples. This is the bedrock of most site-based models (Bayliss and Bronk Ramsey 2004; Bayliss 2009), and has been incorporated into most of the models for enclosures discussed in Chapters 3–12.

A simple example of this kind of prior information is provided by the Harris matrix of dated deposits from the causewayed enclosures at Chalk Hill, Ramsgate, Kent (Fig. 2.13, and see Figs 7.19–22). It is the relative sequence of deposition of the archaeological contexts in this matrix which provides the informative prior beliefs. There is a critical proviso here. Stratigraphy provides a relative sequence of *contexts*. Radiocarbon dating does not date contexts – it dates *samples.* In order to use the relative dating of contexts as informative prior information in our models, it is therefore imperative that the order of the deposition of the contexts is the same as the order in which the organisms which provide the radiocarbon samples died. This means that the samples *must* have been recently dead when deposited in the context from which they were recovered if we are to include them fully in our models.

Some key sites in our study, however, were excavated in the 1920s and 1930s and were recorded by arbitrary spit rather than by stratigraphic context. In these cases the stratigraphic sequence of samples had to be inferred by projecting the spits on to the recorded sections. Often this enabled us to assign potential samples to the basal fills, or to more finds-rich deposits on top of the primary silting, or to secondary fills. This outline sequence was then incorporated into our models. We trialled this approach on the archive of the excavations at Windmill Hill undertaken by Alexander Keiller in 1925–9, where we could compare the results from the spit-dug trenches with those from excavations undertaken in 1957–58 and 1988 (Chapter 3.1). In fact, the use of material excavated by spits proved, perhaps surprisingly, viable (see below, section 2.7.2) and so we were able to undertake dating programmes on other sites excavated in this way, most successfully at Whitehawk Camp, East Sussex (Chapter 5.1) and Hembury, Devon (Chapter 10.2).

The unravelling of the relative date of deposits on a site, whether by single context recording and Harris matrices or by the interpretation of older archives, and the identification of samples which are close in age to those deposits, is critical. This is because informative prior beliefs are just that – informative. They are very powerful and make a substantive difference to the outputs of the model. This is important in two ways. First, because it affects the outputs of the model so strongly, if the informative prior information which we include in a model is incorrect, then there is a good chance that the outputs of the model will also be incorrect.[7] Second, informative prior information is an extremely cost-effective way of obtaining precise chronologies, and can be essential for their production in parts of the radiocarbon calibration curve where wiggles and plateaux are particularly acute. Consequently, we want to include as much informative prior information in our models as possible.

The taphonomy of the dated samples is therefore of fundamental importance. How did the datable material get into the deposit in which it was found? This is, of course, never known but may be interpreted with varying degrees of certainty by the archaeologist (Fig. 2.14). Our desire to incorporate relative dating from stratigraphy into Bayesian models to produce precise chronologies re-emphasises the need to consider archaeological taphonomy in the selection of samples for radiocarbon dating. These considerations are considered in detail in sections 2.5 and 2.7.2 below.

Radiocarbon dates on short-life material which is closely associated with the deposition of the context from which it was recovered (such as the articulating bones or refitting sherds from Chalk Hill; Table 7.5) form the backbone of the chronological models presented in this volume. Such samples, crucially, provide information not only about the end of activity on a site, but also about its beginning. Many of our dated samples, however, do not meet the rigorous criteria outlined in section 2.5. These dates provide less information for our models, but they are not entirely useless. If a sample was residual in its context, or was composed of material with an in-built age-offset, then it does usually provide a *terminus post quem* (maximum age) for its context and for any stratigraphically later deposits. Strategically located, such dates can provide extremely effective constraints for parameters of interest (e.g. *GrA-29112* and *OxA-14834* for the construction of the inner ditch of the causewayed enclosure at Maiden Castle; Fig. 4.42). Overall, 511 (29%) of the 1782 radiocarbon dates included in at least one of the models presented in this volume have been incorporated as *termini post quos* (Fig. 2.15).[8] A few dates have been incorporated into the models as *termini ante quos* (minimum ages). These are rare, since the dated context must be later than the enclosure or other archaeological activity of interest and the sample must be of short-life material and closely associated with that context. Residual samples or those containing potentially

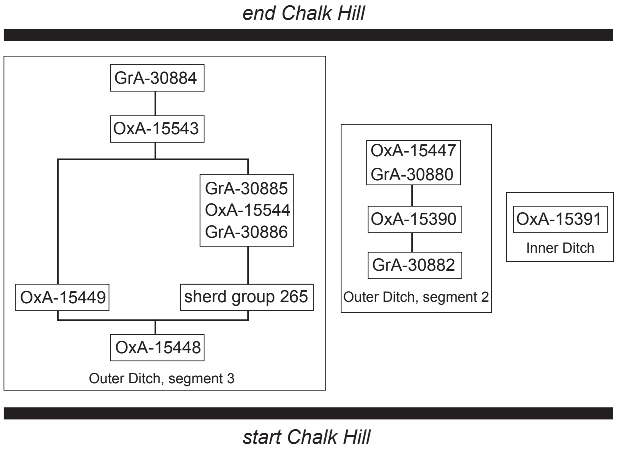


Fig. 2.13. Schematic diagram showing the prior information included in the chronological model for the enclosure at Chalk Hill, Ramsgate, Kent (Fig. 7.21).

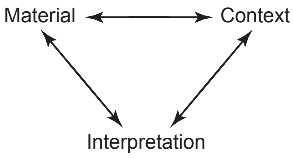


Fig. 2.14. The relationship between interpretation, an archaeological context and the material recovered from it.

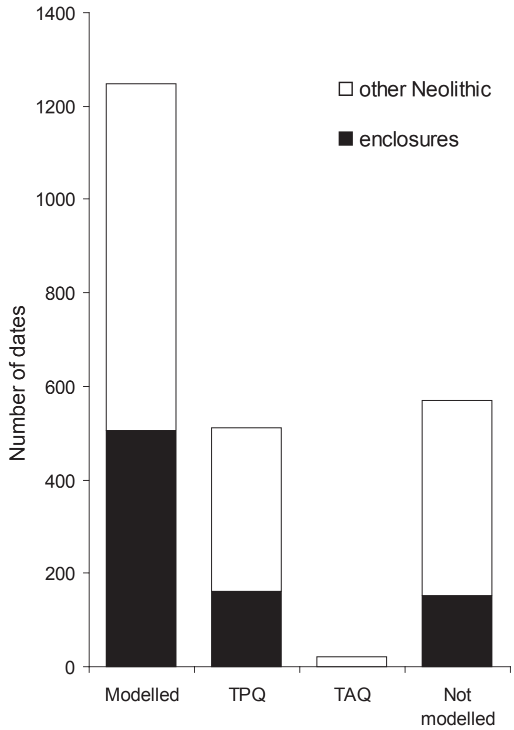


Fig. 2.15. How the corpus of radiocarbon dates considered in this volume has been modelled (n=2350).

long-lived material cannot be used as *termini ante quos* in chronological models.

Although stratigraphy is the most common type of informative prior information included in the models described in this volume, it is not the only type. On occasion we have also incorporated in our models the relative sequence and number of years between samples of wood taken from floating tree-ring sequences (e.g. Haddenham long barrow, Fig. 6.17). This very informative prior information leads to a special variety of analysis, known as Bayesian wiggle-matching (Christen and Litton 1995; Bronk Ramsey *et al.* 2001; Bayliss 2007). Also on the basis of our understanding of the formation of wood samples, occasionally we have offset radiocarbon dates by the number of missing sapwood rings on a timber (e.g. Raunds long barrow, Fig 6.27; Hillam *et al.* 1987; Bayliss and Tyers 2004).

2.4.3 Standardised likelihoods

Prior beliefs form one of the generic components of Bayesian models. The second generic component is composed of the 'standardised likelihoods' (Fig. 2.4) – the data that are interpreted in the light of our prior beliefs. In chronological modelling in archaeology, standardised likelihoods usually take the form of dates derived from scientific methods. On occasion, however, dates from documentary sources, coins or inscriptions might also be included in models (e.g. Sidell *et al.* 2007).

In this study the overwhelming majority of the standardised likelihoods are radiocarbon dates. We have considered 2350 radiocarbon dates in detail in this volume. In contrast, there are six OSL ages from the two cursus monuments at Eynesbury, Cambridgeshire (Table 6.5) and three TL ages from sherds of Ebbsfleet Ware from the disturbed site at High Rocks, Tunbridge Wells, Kent (Chapter 7.6). There are also tree-ring dates for the Sweet Track, Somerset (Chapter 14.5), and a trackway at Derrygreenagh Bog, Co. Westmeath, Ireland (Table 12.7). Of these, 1782 radiocarbon dates, the six luminescence ages from Eynesbury, and both tree-ring dates have been included in at least one of the chronological models presented here.

Dendrochronology and luminescence dating both provide dates on the calendar scale (English Heritage 1998; Duller 2008); radiocarbon dating does not. So, before our radiocarbon measurements can be incorporated as radiocarbon dates into our chronological models, they have to be calibrated on to the calendar timescale (Pearson 1987). Since the Bayesian approach is fundamentally probabilistic, we implement the probability method of radiocarbon calibration (Stuiver and Reimer 1993; Dehling and van der Plicht 1993; van der Plicht 1993). This is illustrated in Fig. 2.16. We consider the radiocarbon age in equal-sized segments called bins (e.g. covering one radiocarbon year). Each bin of probability of the radiocarbon age is converted to one or more probability values on the calendar scale by means of the calibration curve (in Fig. 2.16 the probability at 4725 BP is distributed between calendar dates in the last quarter of the 37th century cal BC, the last quarter of the 36th century cal BC and the first quarter of the 34th century cal BC). Account is taken both of the probability

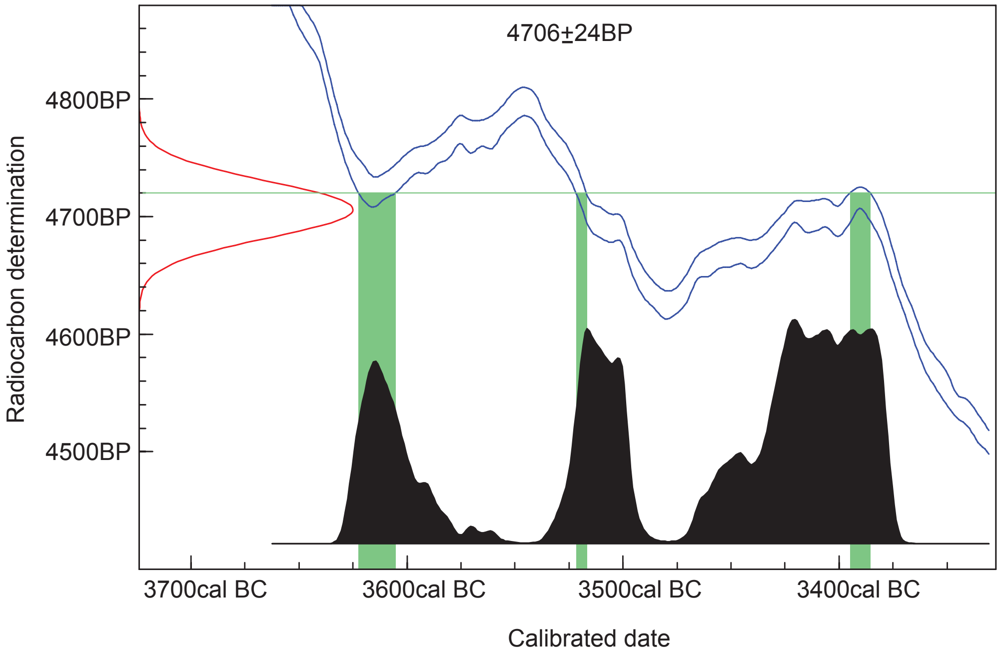


Fig. 2.16. Probability distribution of a calibrated radiocarbon date from the Greater Stonehenge Cursus (032, Table 4.13).

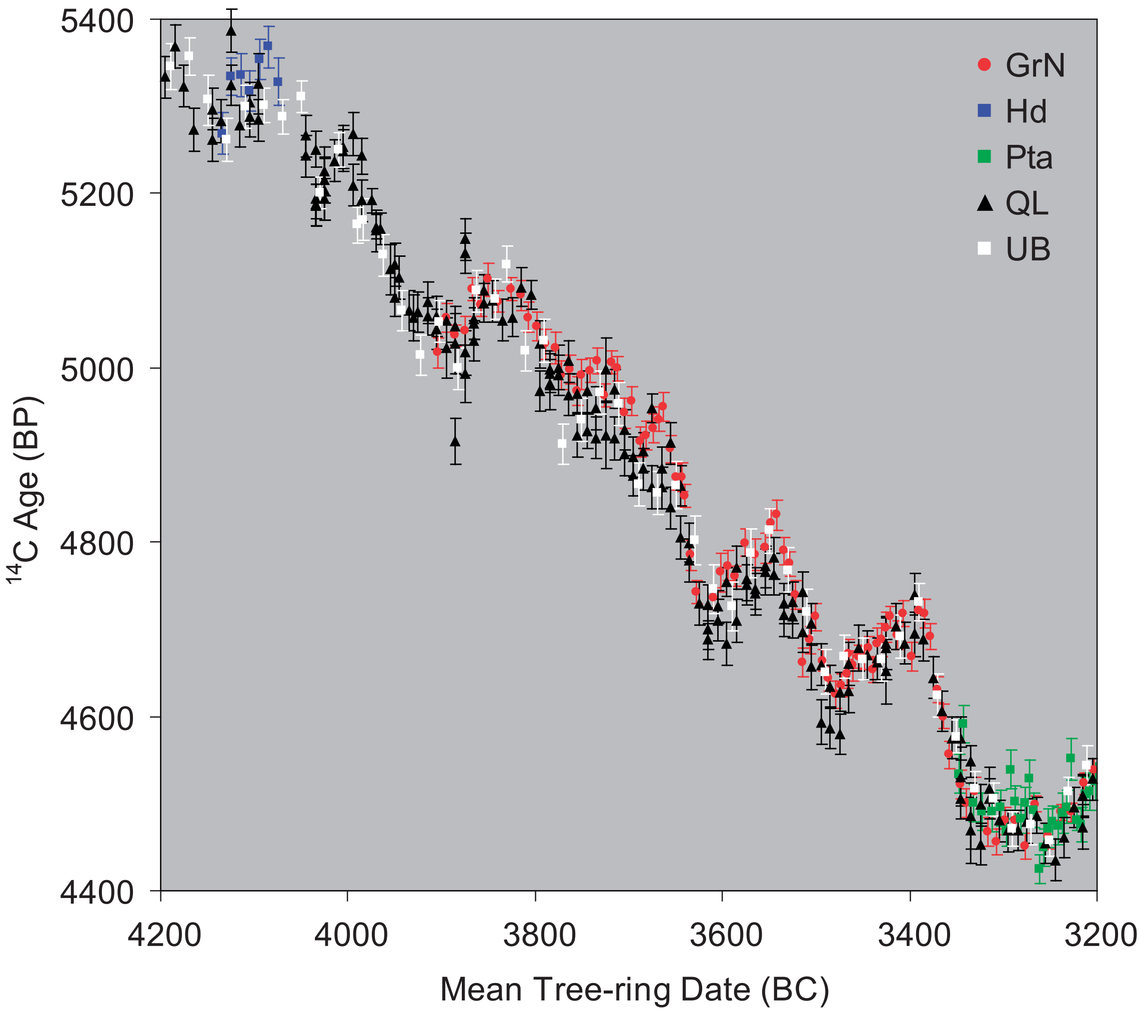


Fig. 2.17. Radiocarbon measurements included in INTCAL04 (Reimer et al. *2004) on wood dated by dendrochronology to between 4200 BC and 3200 BC (GrN – Rijksuniversiteit Groningen; Hd – Heidelberger Akademie der Wissenschaften; PtA – National Physical Research Laboratory, Pretoria; QL – University of Washington, Seattle; UB – The Queen's University, Belfast).*

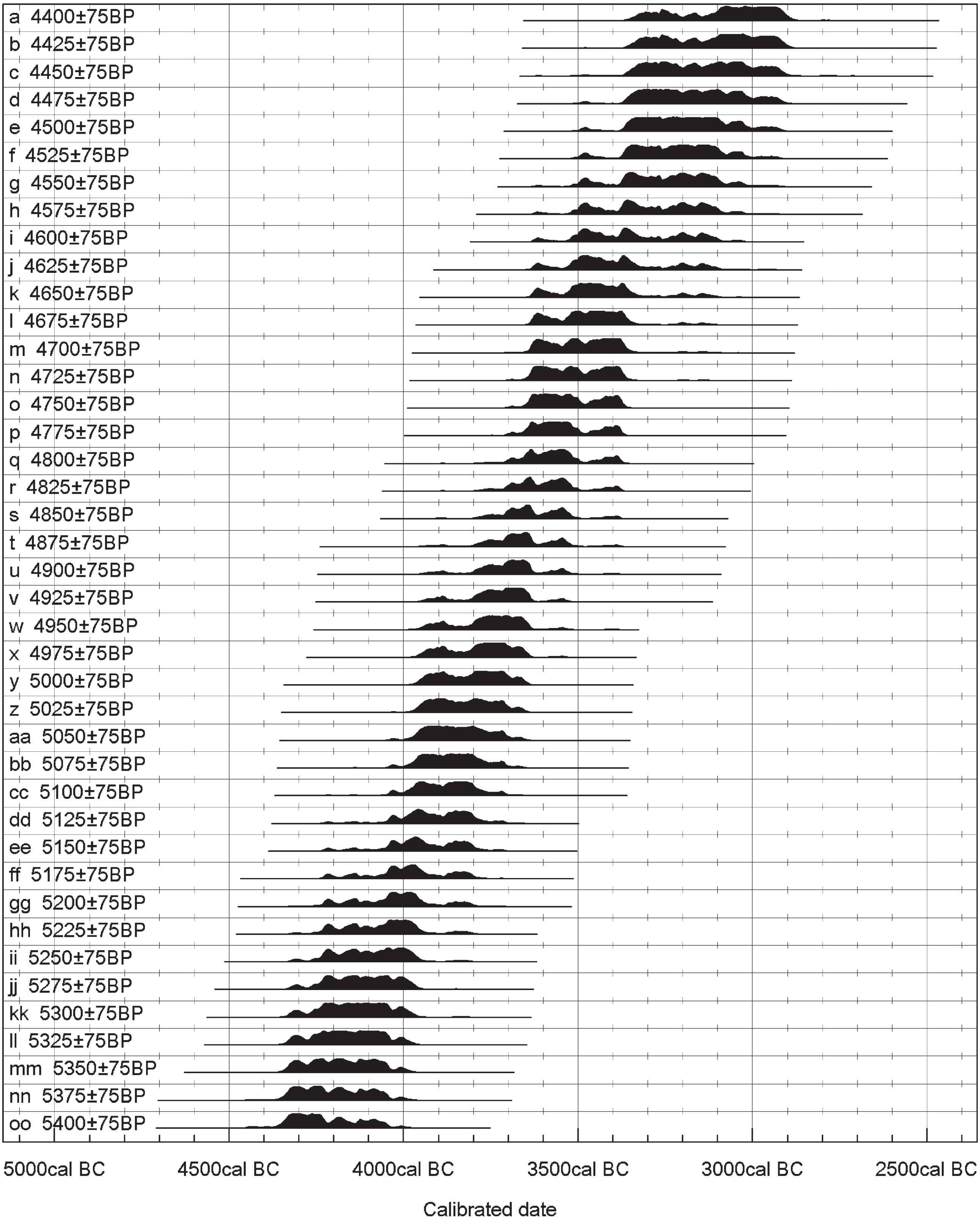


Fig. 2.18. Probability distributions of calibrated radiocarbon dates from radiocarbon ages spanning 5400–4400 BP (with measurement errors of ±75 BP).

of the radiocarbon age and the error term on the calibration curve. The sum of the probability values at each bin on the calendar scale, once all the probability in the radiocarbon age has been transferred, forms the probability distribution of the calibrated radiocarbon date. It is this probability distribution which forms a standardised likelihood for a Bayesian model.

Figure 2.16 illustrates the effect of the wiggles and

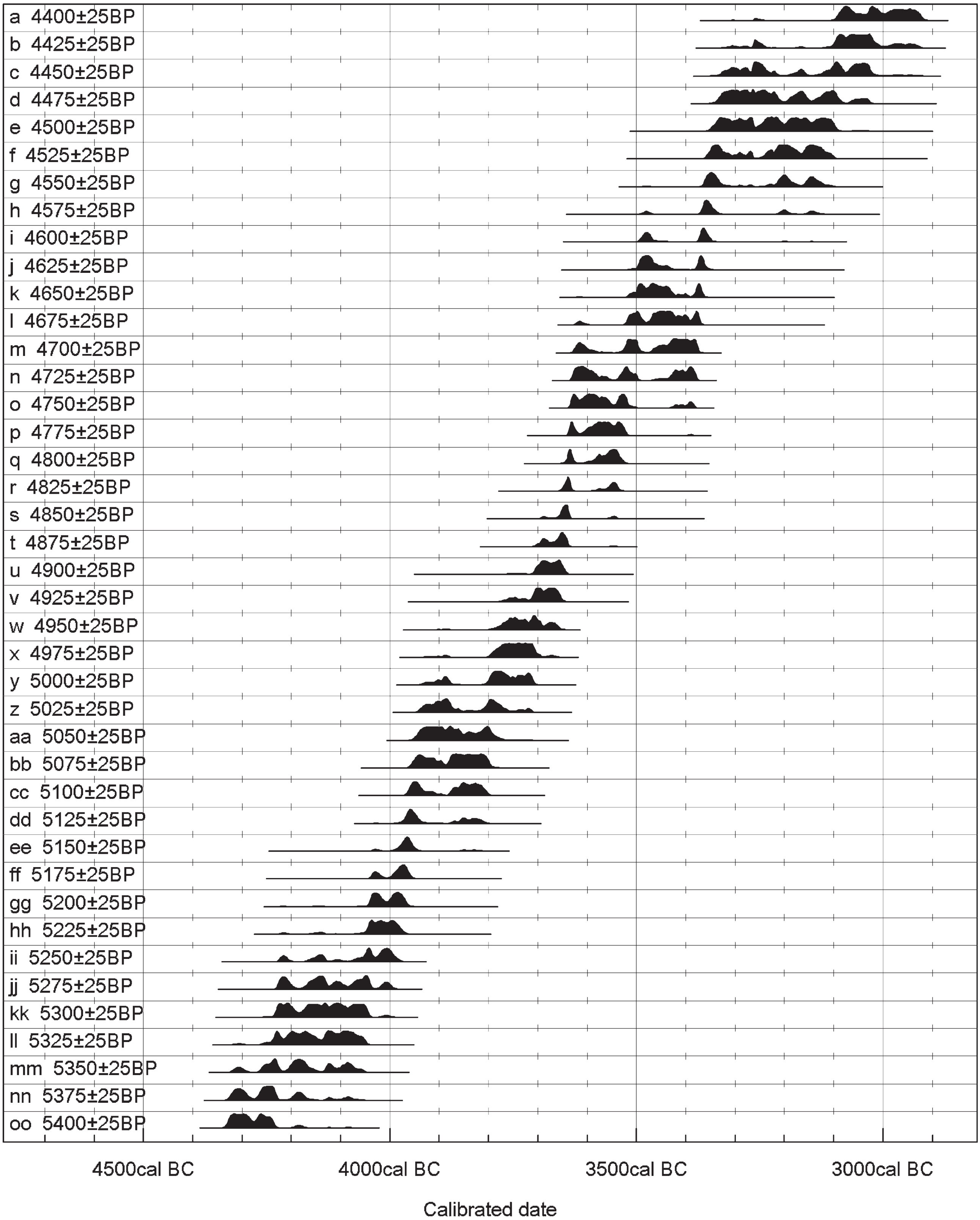


Fig. 2.19. Probability distributions of calibrated radiocarbon dates from radiocarbon ages spanning 5400–4400 BP (with measurement errors of ±25 BP).

plateaux in the radiocarbon calibration curve on the probability distributions of calibrated dates. This radiocarbon sample dates either to 3630–3585 cal BC (19% probability) or to 3530–3490 cal BC (21% probability) or to 3470–3370 cal BC (55% probability). The shape of the radiocarbon calibration curve in the relevant period is therefore a material consideration in the application of Bayesian chronological modelling.

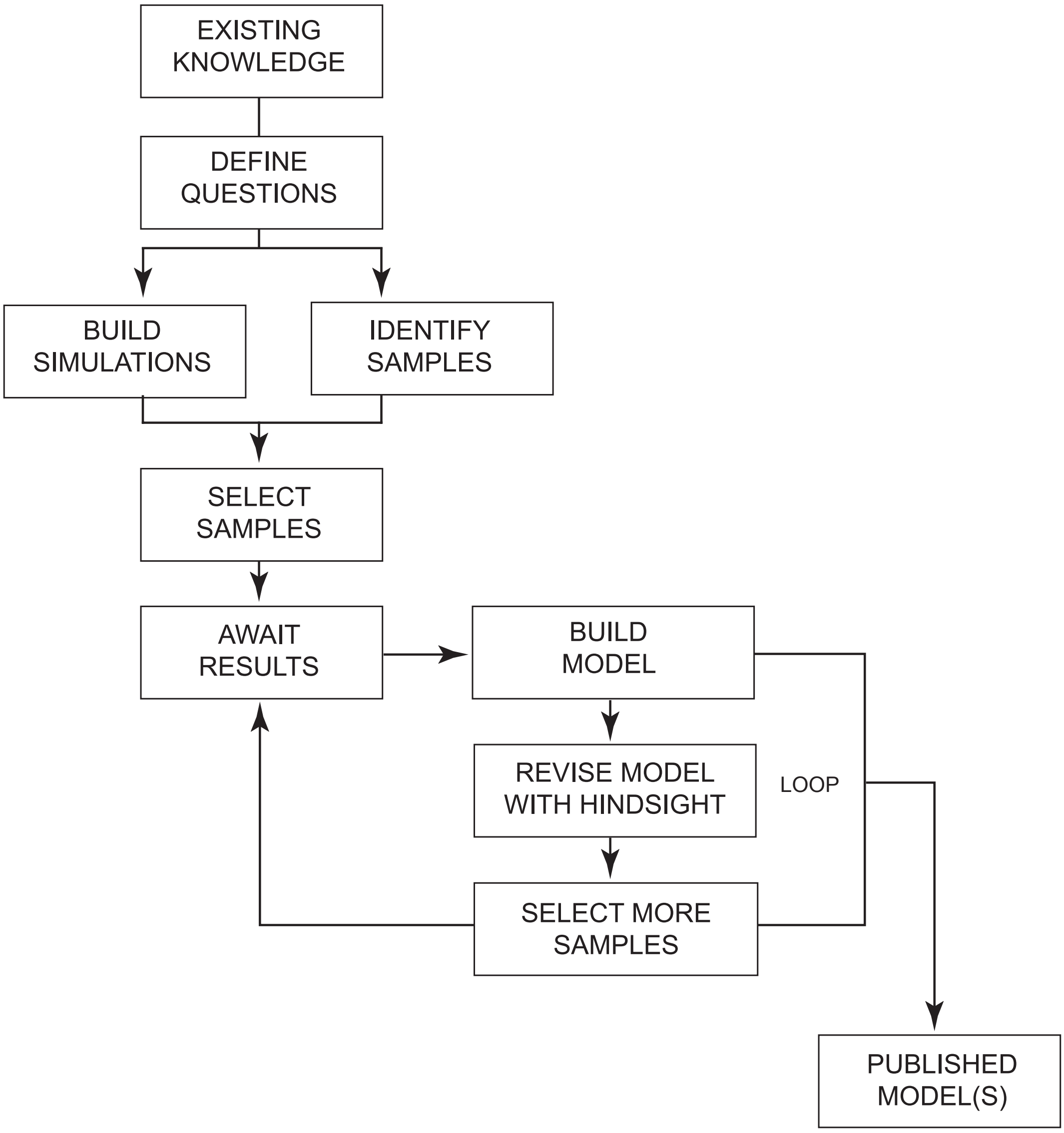


Fig. 2.20. Flow diagram showing the stages in sample selection and chronological modelling.

Fig. 2.21. Charcoal sample recovered in 1926 from Windmill Hill (inner ditch, segment 7, spit 5), as stored since the excavation in the Alexander Keiller Museum, Avebury. Photo: Amanda Grieve.

Fig. 2.22. Articulated cattle ankle from Chalk Hill, Ramsgate (outer ditch, segment 2). Photo: Canterbury Archaeological Trust.

Fig. 2.23. Distal right cattle tibia and astragalus from the inner ditch of the causewayed enclosure at Maiden Castle, possibly articulating (although the surface condition of the two bones is different). Photo: Amanda Grieve.

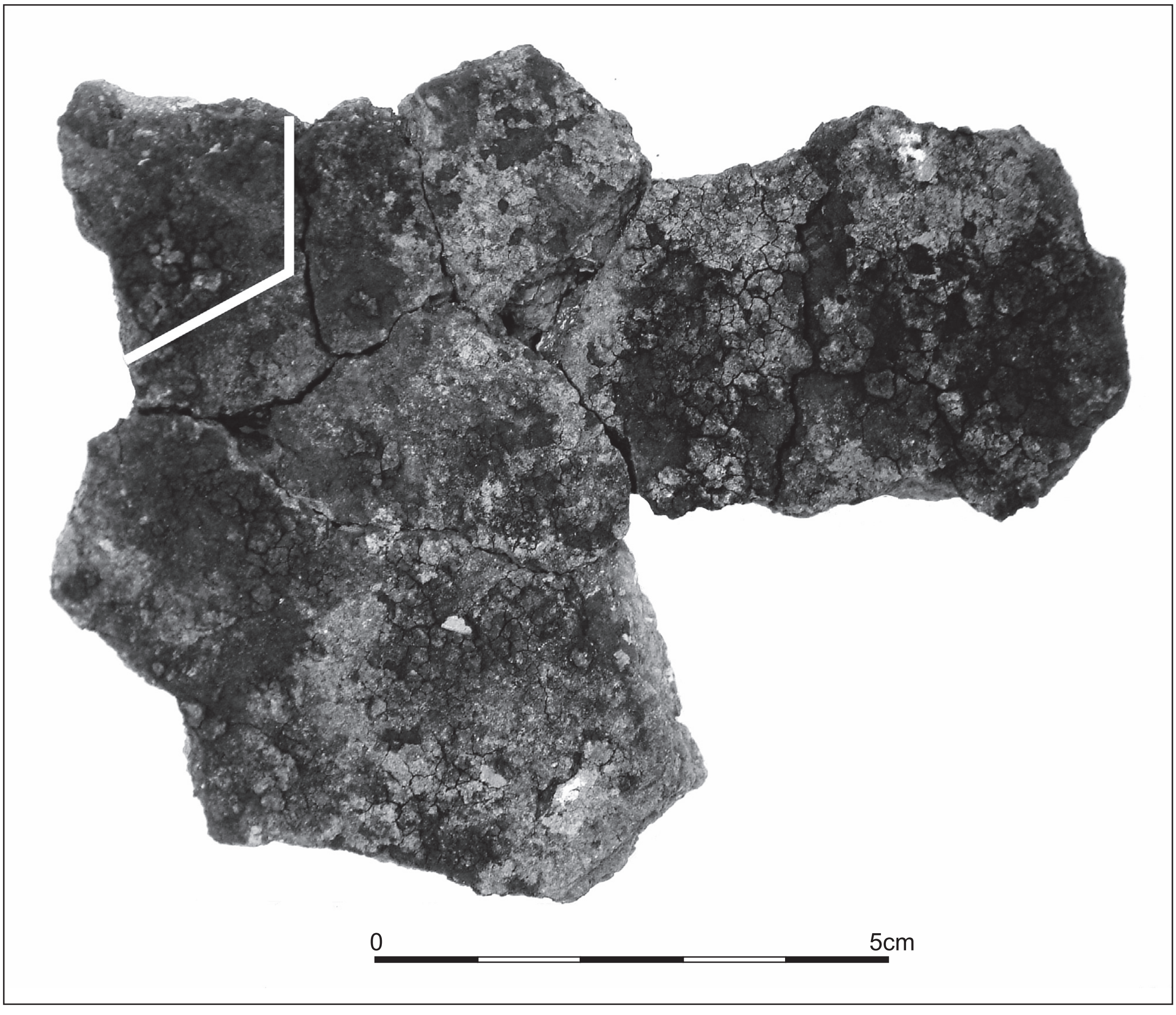


Fig. 2.24. Conjoining sherds of a Neolithic Bowl with internal carbonised residue, from the midden layers in the inner ditch of the causewayed enclosure at Maiden Castle. The red box denotes the area of residue required for AMS dating. Photo: Amanda Grieve.

The data included in the relevant section of the current internationally-agreed calibration curve (INTCAL04; Reimer *et al.* 2004) is shown in Fig. 2.17. In the fifth and fourth millennia BC, this curve is based on blocks of European oak whose calendar date is known by dendrochronology (Pilcher *et al.* 1984). Five sets of data contribute to this section of the calibration curve. Measurements on decadal tree-ring samples were made by the University of Washington, Seattle (Stuiver and Becker 1993; corrected as described by Stuiver *et al.* (1998a) and the Heidelberger Akademie der Wissenschaften (Kromer *et al.* 1986); and bi-decadal tree-ring samples were dated at the Queen's University, Belfast (Pearson *et al.* 1986). Unusually, this section of the curve also contains data with sub-decadal (1–4 calendar years) resolution from the Rijksuniversiteit Groningen (de Jong *et al.* 1986; corrected as described by de Jong *et al.* 1989) and the National Physical Research Laboratory, Pretoria (Vogel *et al.* 1993). This means that the part of the calibration curve of relevance to this study is unusually well replicated, and contains data of a resolution uncommon in the prehistoric period (but see Vogel and van der Plicht 1993). This curve was constructed by a group of laboratories who exchanged standard materials and known-age wood, minimising inter-laboratory offsets to within the range 0–20 BP (Stuiver *et al.* 1998b). For example, the difference between the Groningen and Pretoria conventional laboratories (GrN and PtA) on the same material is on average 7.1±6.4 BP (Vogel *et al.* 1993, 74).

The data-dense and well-replicated nature of the calibration curve in the fourth millennium BC means that we can have confidence that it accurately reflects the changing radiocarbon content of the atmosphere during this period. Because of the high resolution data available from the Groningen and Pretoria laboratories, there is unlikely to be significant additional structure in the shape of the curve at this time, such as has been revealed in other periods by the measurement of more closely-spaced tree-ring samples (McCormac *et al.* 2004; 2008). Since the known-age wood used for the calibration samples itself grew in north-west Europe, it is also unlikely that there is any regional or growing-season offset (Kromer *et al.* 2001) between the calibration curve and archaeological samples from Britain and Ireland.

Figure 2.17 demonstrates that the radiocarbon calibration curve in the fourth millennium BC is characterised more by wiggles than by plateaux. Tree-ring samples from *c.* 4200–*c.* 4050 BC produce a plateau of radiocarbon ages very close to 5300 BP. But thereafter, in the early centuries of the fourth millennium, there are two shallow wiggles (peaking at *c.* 3995 BC and *c.* 3830 BC) separated by steeper sections of curve. The middle centuries of the millennium are covered by two much more pronounced wiggles (each spanning almost 150 BP between *c.* 3610–*c.* 3540 BC and *c.* 3475–3395 BC respectively). Another plateau at *c.* 4500 BP runs from *c.* 3330–*c.* 3000 BC.

We have seen, in Fig. 2.16, how this non-monotonic calibration curve can result in multi-modal probability distributions for the calibrated radiocarbon dates that form the standardised likelihoods component of our chronological models. But is this the usual form of calibrated dates in this period? Figure 2.18 shows the calibrated dates for a series of radiocarbon ages (with error terms of ±75 BP) running from 5400–4400 BP. Although some peaks and troughs of probability are visible in these distributions (e.g. t), in general the wiggles in the calibration curve are not apparent from measurements at this precision. Compare Fig. 2.18 with Fig. 2.19, however, where the same radiocarbon ages have been calibrated, but on this occasion they have error terms of ±25 BP. Much more of the structure of the calibration curve is now apparent in the probability distributions of the calibrated dates. They are more multimodal, and the peaks and troughs in their distributions are more pronounced. Even an apparently severe plateau such as that covering the last centuries of the fourth millennium BC resolves into a series of wiggles and mini-plateaux at this precision.

Measurement precision is one weapon in our battle to obtain precise chronologies notwithstanding the effect of radiocarbon calibration. Except in periods when the radiocarbon content of the atmosphere is changing sharply, it is a relatively blunt tool. By considering a corpus of radiocarbon dates and the relationships between them together, however, prior beliefs in a Bayesian model can perform a similar function. The model determines which part of a standardised likelihood is most probable given the available prior information, effectively matching a sequence of radiocarbon dates to the detailed structure of the calibration curve.[9]

Standardised likelihoods are shown in the graphs in this volume in outline. Sometimes, especially when a model has little informative prior information, these distributions may be hidden behind the posterior density estimate of the same date (which is shown in black). In this case, the label for the distribution will appear *in italics*, since it is a posterior density estimate. Distributions followed by a '?' on the graphs are calibrated radiocarbon dates, which have not been included in the model for reasons discussed in the text.

2.4.4 Calculating posterior density estimates

Once the components of a Bayesian model have been assembled – the standardised likelihoods obtained and the prior beliefs explicitly defined – they can be combined using Bayes' theorem (Fig. 2.4). This is done using a Markov chain Monte Carlo (MCMC) random sampling technique. In this study all modelling has been undertaken using OxCal v3.10, which utilises a mixture of the Metropolis-Hastings algorithm and the more specific Gibbs sampler (Gelfand and Smith 1990; Gilks *et al.* 1996).

Two statistics are calculated by OxCal which aid the archaeologist in an assessment of the reliability of a model. The first of these is the individual index of agreement (A: Bronk Ramsey 1995, 429). This index provides a measure of how well any posterior density estimate agrees with the standardised likelihood from which it derives. If the posterior

density estimate is situated in a high-probability region of the likelihood, the index of agreement is high; if it falls in a low-probability region, it is low. If the index of agreement falls below 60%, then the radiocarbon result may be in some way problematic. It should be noted that this threshold has been empirically derived, and in practice provides only an indication of when a date may be inconsistent with the model employed (about 1 in 20 dates will have a low index of agreement simply on statistical grounds). The index of agreement is not a quantitative measure of how well a date 'fits' the model. For example, in Fig. 2.6, *m* has an index of agreement of 114.9%, whereas *l* has an index of agreement of 63.1%. Date *m* is no more consistent with the constraints of the model than date *l* – both dates are accurate and entirely compatible with the prior information included in the model (remember, this is a simulation which has been designed thus!). Equally date *k*, which has a poor individual index of agreement (A=46.2%), is also entirely consistent with the model employed.

This example highlights how we have utilised individual agreement indices in this study – as a trigger which prompts the re-examination of the accuracy of a particular date or set of prior information (according to the criteria set out in sections 2.5 and 2.6). Sometimes a low index of agreement merely indicates that the radiocarbon date is a statistical outlier, although a very low value may suggest that a sample is residual or intrusive (i.e. that the calendar age of the sample is different to that implied by the stratigraphic position of the context from which it was recovered), or that it may have been contaminated. Dates with low individual indices of agreement are not excluded from the analysis if detailed re-assessment suggests that they are simply statistical outliers rather than dates which are inaccurate on either archaeological or scientific grounds.

The second statistic is the overall index of agreement, which is calculated from the individual agreement indices ($A_{overall}$: Bronk Ramsey 1995, 249). This provides a more general measure of the consistency between the prior information and the standardised likelihoods. Again, the overall index of agreement has a threshold value of 60%, and models which produce values lower than this should be subject to critical re-examination. Usually, a low overall index of agreement is derived from a small number of misfits – dates on residual, intrusive or contaminated samples. These can be identified through very low individual indices of agreement and, in most cases, can be explained by detailed consideration of the archaeological evidence or laboratory procedures. The model can be modified and re-run according to our re-interpretation of these data. For example, samples which have proven residual provide *termini post quos* for their contexts and have no relationship with stratigraphically earlier samples. Samples whose radiocarbon ages appear anomalous have been excluded from the analysis. The names of these distributions are followed by a '?' in the graphs, with the relevant calibrated radiocarbon date shown in black. The reasoning behind individual decisions to exclude particular measurements is explained in the accompanying text.

A third statistic is calculated by OxCal which allows us to determine whether a model is stable. This is known as convergence. This is a measure of how quickly the MCMC sampler is able to produce a representative and stable solution to the model. Details of the measure used in OxCal (C) may be found in Bronk Ramsey (1995, 429). In practice, a model whose convergence is poor (less than 95%) is unstable and the results should not be used. None of the models reported in this study have poor convergence.

2.5 The Bayesian process

The iterative approach to radiocarbon sampling and chronological modelling which we have adopted in this study is summarised in Fig. 2.20. This methodology has been developed over the past 15 years to ensure that best value is obtained routinely for dating projects funded by English Heritage (Bayliss and Bronk Ramsey 2004). It has been refined through practice. We have now dated more than 500 sites and submitted well over 3000 radiocarbon samples using this framework for sample selection (Bayliss 2009, fig. 11).

2.5.1 Groundworks

The first step is to determine exactly what is known about the chronology of a site before any new samples are submitted for dating. To this end, we elicit the precise archaeological provenance of each of the existing radiocarbon dates from a site, establish precisely what material has been sampled and the methods used to date it, and construct stratigraphic matrices of the contexts from which the samples were recovered. In practice, this is a considerable task that requires research in both published sources and a wide range of archives. Excess material surviving from samples dated in earlier decades is retrieved from storage and retrospectively identified to age and species; stratigraphic sequences are culled from detailed readings of site publications or from unpublished excavation archives; laboratory procedures are traced from technical publications or by contacting the laboratories concerned.

This detailed information enables us to build chronological models of sites using the existing radiocarbon dates (e.g. Windmill Hill, Fig. 3.6). From it we are able to assess the accuracy of the existing radiocarbon measurements (see sections 2.6 and 2.7 below) and so determine which calibrated radiocarbon dates should be included as standardised likelihoods in our model. Crucially, we are also able to interpret the relationships between the dated samples and the contexts from which they were recovered (see section 2.5.2 below), and so define, retrospectively as it were, the prior information that can be included in our model.

The quality of the dating information available before this project began varied immensely. For some sites, such as Banc Du, Pembrokeshire (Chapter 11.3), the suggestion that they were Neolithic rested solely on the

Fig. 2.25. Shed antler with signs of charring and a very worn burr (used as a hammer?) recovered from the lowest fill of pit 2276, which was cut into the primary fills of the Maiden Castle long mound. Conventional dating would require the destruction of the entire specimen; AMS dating was undertaken on the fragment outlined in red. Photo: Amanda Grieve.

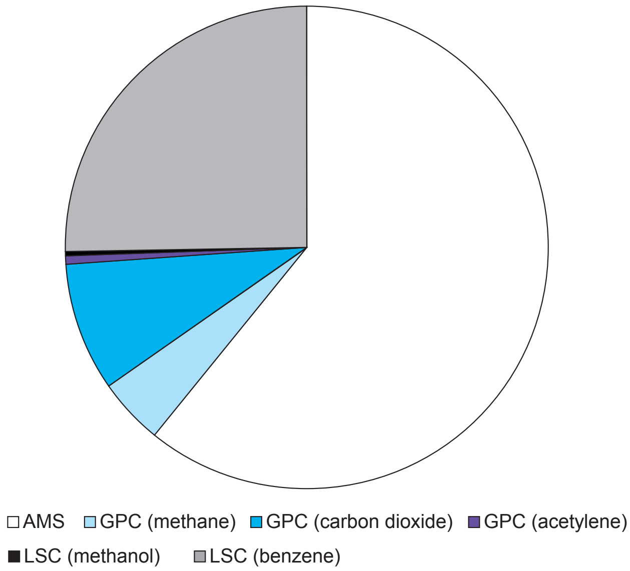


Fig. 2.26. Numbers of radiocarbon measurements considered in this volume measured using different techniques (n=2350).

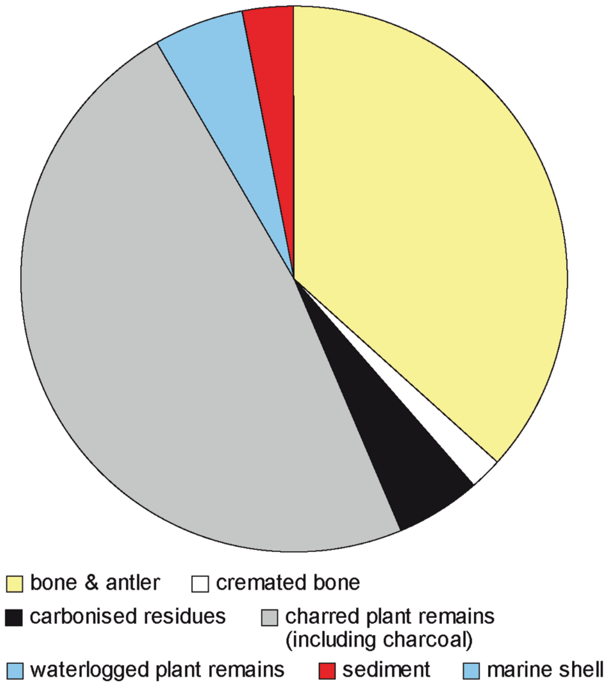


Fig. 2.27. Numbers of radiocarbon measurements considered in this volume obtained from different material types (n=2350).

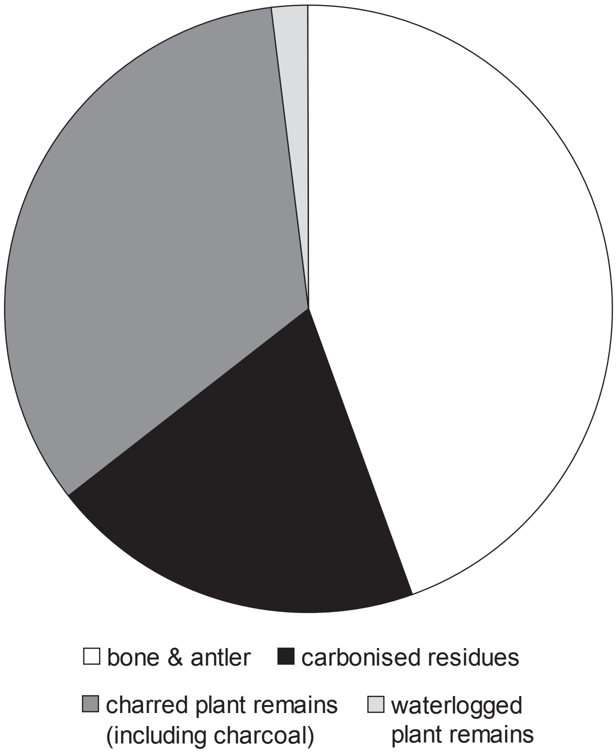


Fig. 2.28. Numbers of radiocarbon dates obtained during this study from different material types (n=427).

form of the enclosure. For others, such as Hill Croft Field, Herefordshire (Chapter 11.1), a Neolithic date was postulated on the basis of the recovery of Neolithic finds such as Bowl pottery. Some sites, such as Orsett, Essex (Chapter 7.2), although possessing the appropriate form and finds, had yielded a handful of existing radiocarbon dates, of varying reliability, which did little more than suggest that the site was used sometime within the fourth millennium cal BC. In contrast, other sites, such as Maiden Castle (Chapter 4.3), already possessed substantial suites of radiocarbon dates. In these cases, formal modelling of the existing radiocarbon dates substantially refined our understanding of the chronologies of the sites even before any additional samples were submitted for dating (see Table 4.10; or compare Figs 3.4 and 3.5).

Once we had established our interpretation of the chronology of a site based on existing information, we could consider what other questions the dating programme should be designed to address. In addition to the general project aims set out in Chapter 1.4, we also considered subsidiary, site-specific objectives that might relate to the development of a particular monument complex or series of sites in a locality. The objectives of each sampling programme are set out for each site in the regional chapters which follow (Chapters 3–12). The formulation of explicit research objectives is an essential step in the process of Bayesian chronological modelling because the aims of a project materially affect the model we construct and the samples we submit for dating (see section 2.5.3 below).

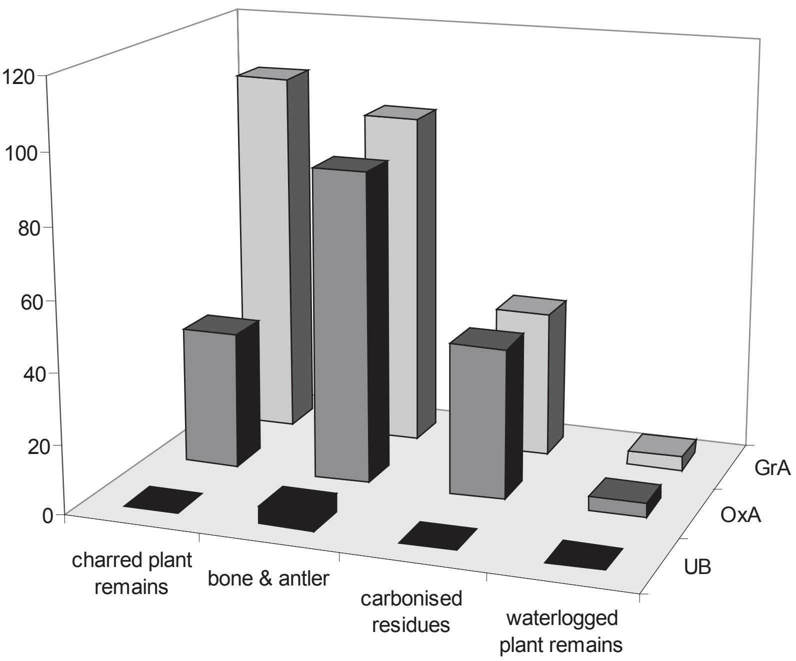


Fig. 2.29. Numbers of radiocarbon measurements made on each sample type by laboratories in the 2004–7 dating programme.

2.5.2 Identifying suitable samples

The next step in the process of construction of Bayesian chronologies is to identify a pool of samples that are suitable for dating (Fig. 2.20). This is a complex task, involving all the technical intricacies of radiocarbon dating and requiring rigorous consideration of some difficult archaeological problems.

There are three basic criteria which a sample must meet before it can be considered suitable for radiocarbon dating. First, the carbon in the sampled organism must be in equilibrium with the carbon in the atmosphere (or some other well-characterised reservoir) at the time when the organism died. By far the most common source of error of this type is the 'old-wood effect' (Bowman 1990, 51), where dates are obtained on wood or charcoal from long-lived plants. The carbon in a tree-ring dates from the year in which that tree-ring was laid down (that is why radiocarbon calibration works!), and so all samples should consist of twigs or the outer rings of the tree. Samples of heartwood from long-lived species, such as oak, or samples which have not been identified to age and species before dating can only be incorporated into models as *termini post quos* (and are thus far less effective at producing precise chronologies). All the samples submitted for dating as part of this project consisted of short-life material, although in a few cases oak charcoal which was only probably identified as sapwood was dated (see Chapter 5.1).

Other effects which can complicate the relationship between the carbon absorbed by the sampled organism in life and the contemporary atmosphere are isotopic fractionation (Bowman 1990, 20–1) and reservoir effects (Bowman 1990, 24–7). All the dates produced during the course of this study are conventional radiocarbon ages and have been corrected for isotopic fractionation using measured $\delta^{13}C$ values. Those listed in this volume were measured by conventional mass spectrometry unless otherwise specified (and see Table 2.3). It has not been possible to determine exactly how many of the other radiocarbon ages considered in this study have not been corrected for fractionation (using either measured or global average values). Based on the date when the measurements were made, however, probably under 5% of the total corpus of radiocarbon determinations are uncorrected. There are no samples from marine or freshwater reservoirs from enclosures, and only three from marine sources in the entire study (Tables 12.10 and 14.14). These ages have been calibrated as described in section 2.1, taking into account their marine origin. As there seems to have been very little if any use of marine resources during the Neolithic in southern Britain (Hedges *et al.* 2007b; M. Richards 2000; M. Richards *et al.* 2003), all radiocarbon ages on Neolithic human bone have been calibrated as fully terrestrial samples. The exceptions are the two individuals with strongly marine isotopic signatures from Ferriter's Cove discussed in section 2.1.

The second criterion which a sample must meet if it is to be considered for radiocarbon dating is that it must not be contaminated by any other carbon-containing material. This is a tall order. Almost all samples are contaminated by their burial environments, and radiocarbon laboratories go to great trouble to remove such contamination. This is the reason for the chemical pre-treatment protocols adopted by all radiocarbon laboratories since the earliest years of the method. Over time, however, some approaches have proven more reliable in practice than others. This is the reason why we have attempted to track down how each sample in our study was prepared and dated (see section 2.6 below). The major archaeologist-derived contaminants that have been encountered in this study are Polyvinyl Acetate (PVA), a consolidant which had been applied to a handful of the bone samples, glues (of unknown and probably variable composition) which had been used to reconstruct many of the groups of refitting pottery sherds with carbonised residues and some of the antlers and bones sampled, and varnish (again of unknown and probably variable composition) which covered many of the context notations which had been marked on bones and sherds in Indian ink. A few of the specimens recovered during excavations in the 1920s and 1930s had been reconstructed using plaster of Paris. Packaging was varied (Fig. 2.21).

The third basic criterion which a sample must meet before it is dated is that it must be securely associated with the archaeological activity that is of interest. The importance of this relationship between the *dated event* (e.g. the shedding of an antler) and the *target event* (e.g. the digging of a Neolithic ditch) has been highlighted repeatedly since the seminal paper on the subject by Waterbolk (1971), but routinely still far too little attention is paid to the association between the sample, the context from which it was recovered and the archaeological event that our dating targets (Dean 1978; Van Strydonck *et al.* 1999; Bayliss 2009). Bayesian modelling, because of our desire to incorporate informative prior information from stratigraphy in our models, reinforces the critical importance of the taphonomy of the dated material and the association between it and the past activity which we wish to date. As this relationship is never known, but inferred on the basis of archaeological evidence (Fig. 2.14), we have explicitly described the basis of our taphonomic interpretation of each sample in the detailed description of each model given in the regional chapters (Chapters 3–12, and Chapter 14.7 for Scotland). This may seem tedious, but it is fundamental to how we have incorporated each standardised likelihood into our models. Bayesian modelling is an explicit, statistical process and demands that we make a clear, open and unequivocal decision about how to model each and every radiocarbon date in our study.

Since it is the interpretation of the taphonomy of the dated material which so often goes awry in archaeological sample selection, it is perhaps worth outlining in some detail the grounds we have used for making this inference in this study. The following categories of samples have been submitted for dating, in roughly descending order of reliability:

1) Bones found in articulation and recorded in the ground as such (Fig. 2.22). These samples would have been still connected by soft tissue when buried and hence

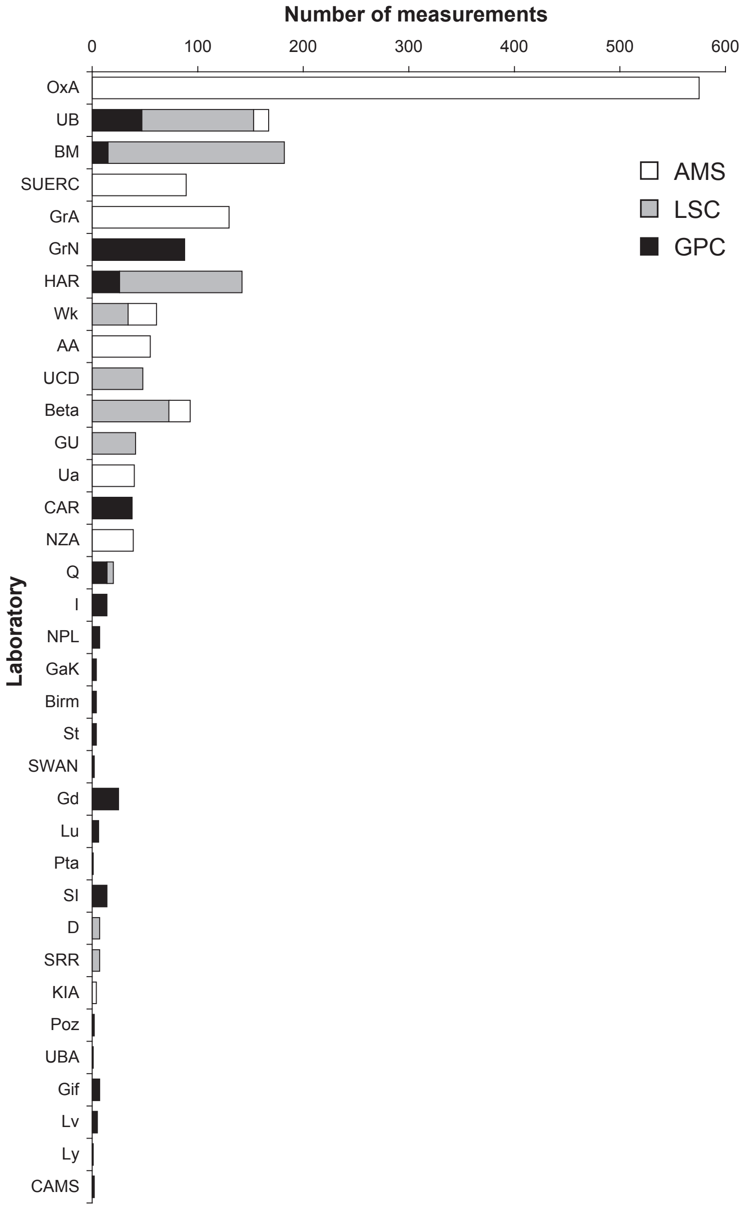


Fig. 2.30. Numbers of radiocarbon measurements by laboratory from samples included in this study but dated by previous researchers (n=1923).

from animals which were not long dead (Mant 1987, 71).

2) Articulating bones identified as such during faunal analysis (Fig. 2.23). These samples may have been articulated in the ground (but not recognised as such) or have only been slightly disturbed before burial. The presence of more than one bone from the same individual provides evidence that such samples are close in age to their contexts. The security of this inference increases as the number of articulating bones increases.
3) Bones with refitting unfused epiphyses identified during faunal analysis: see 2) above.
4) Carbonised residues adhering to the interior surface of groups of refitting pottery sherds (Fig. 2.24) or from a group of sherds thought to derive from a single vessel. As the residues are on the interior of the vessel, this material probably represents the remains of charred food (rather than sooting) and, since the sherds refit or much of a pot survives, the vessel has a good chance of being in the place where it was originally discarded (see sections 2.6 and 2.7 below for the reliability of dates on carbonised residues from pottery).
5) Antler tools discarded on the base of ditches and other negative features (Fig. 2.25): thought to be functionally related to the digging of the features. This inference is most secure when the tine is embedded in the base of the cut or striations from the picks are visible in the substrate.
6) Short-lived parts of waterlogged wood. This was

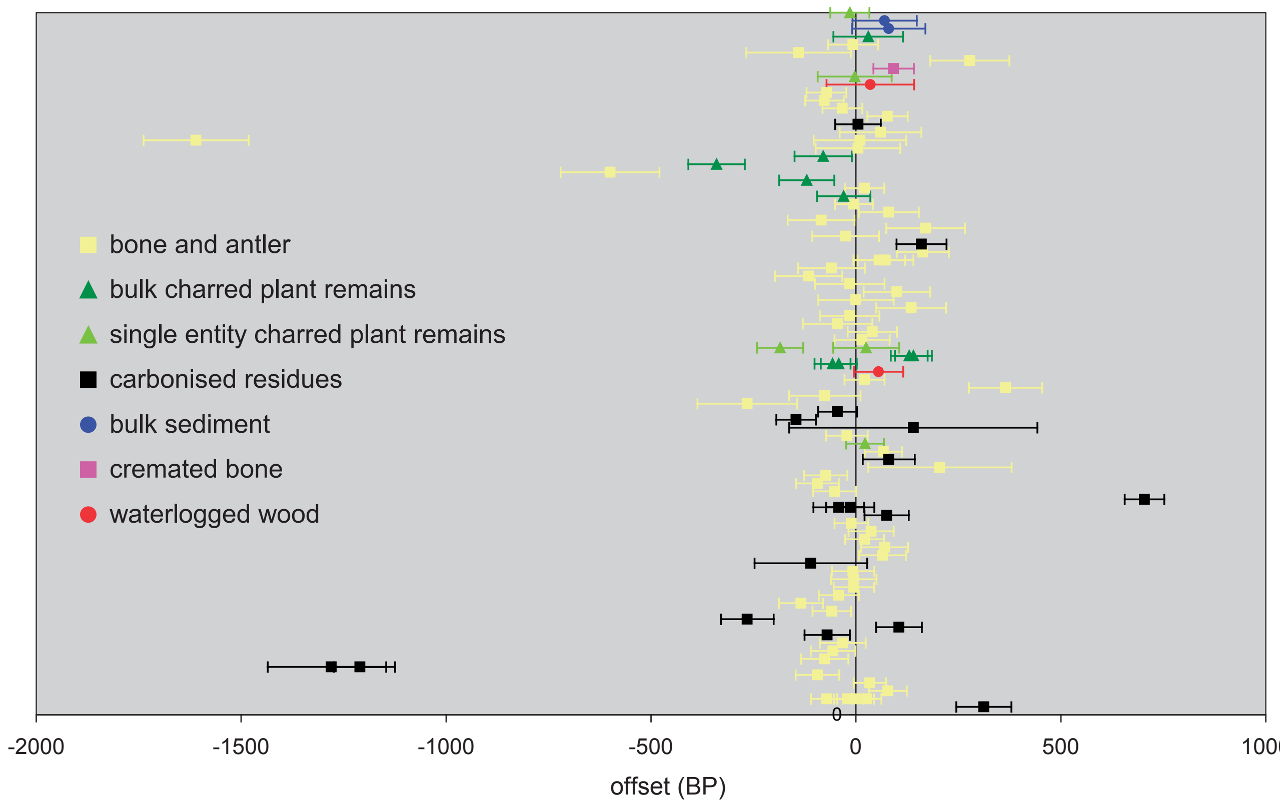


Figure 2.31. Offsets between replicate pairs of radiocarbon results on samples considered in this study (where there are more than two measurements, the first measurement listed in Table 2.4 is compared with each succeeding measurement).

probably in the original context in which it was deposited or it would not have remained waterlogged and survived.

7) Single fragments of short-lived charred plant remains functionally related to the context from which they were recovered (e.g. charcoal from a hearth or cremation pyre, or the outer sapwood rings of charred posts).
8) Paired bones (usually from different sides, e.g. left and right ulnae) thought to be from a single individual on the basis of size, morphology etc: see 3) above but less secure.
9) Groups of bones thought to have been deliberately deposited together at the same time (e.g. bundles of cattle ribs). Fresh deposition is inferred on the basis of the depositional context.
10) Single fragments of short-lived charred plant remains from coherent, often friable or ashy, dumps of charred material: inferred on the basis of their coherence and fragility to be primary disposal events.
11) Carbonised residues adhering to the interior surface of a single pottery sherd: see 4) above. The inference that the sherd is not residual is on the basis of the inherent fragility of early Neolithic pottery fabrics and the superficial nature of the residue.
12) Well-preserved disarticulated animal bones: submitted on the basis that the latest date from a group of measurements should provide a *terminus post quem* which is (hopefully) not too much earlier than the actual date of interest.

These categories cover all the new samples submitted for dating as part of this project. It is obvious that none is fool-proof (even complete articulated skeletons can be in unidentified re-cuts or mummified!), and our inferences are of descending security. Wherever there has been a choice of suitable material, we have, of course, always submitted samples from as close to the top of this list as possible. But in reality there is not always choice. As we will see in the next section, sometimes our sample choice is tactical. We may deliberately choose to submit a potentially residual sample as a *terminus post quem* for an overlying context because simulation demonstrates that it provides an effective constraint for our developing model (see, for example, TPQ 2233, Fig. 4.40).

Pre-existing dates from enclosures and other aspects of the early Neolithic of Britain and Ireland have been retrospectively assessed by these same criteria and modelled accordingly. These dates, however, raise a whole battery of other taphonomic interpretations that again range from the secure to the completely unknown. It is obvious that most of these samples were originally submitted for dating either without explicit consideration of the relationship between the dated event and the target event, or in desperation, simply because they were the only samples large enough for conventional dating (see section 2.6 below).

The most secure of these associations are dates which

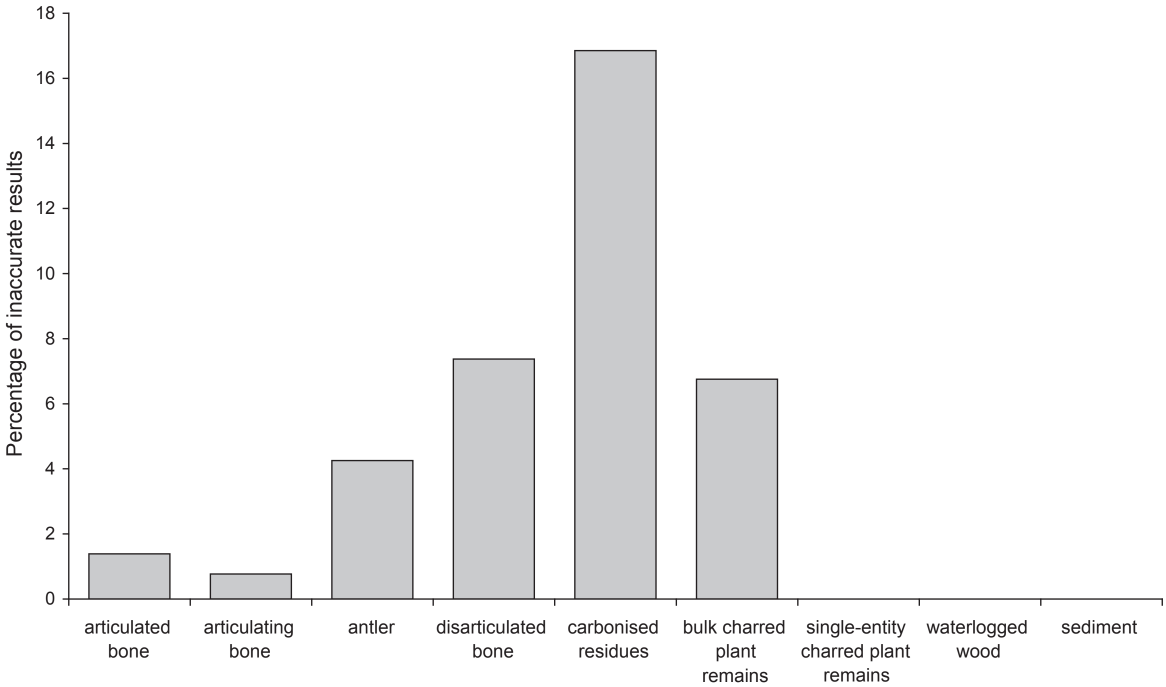


Figure 2.32. Proportions of radiocarbon measurements from Neolithic enclosures (n=816) of different material types judged to be inaccurate on archaeological grounds.

are actually on the material of interest – for example, measurements on cereal grains or bones of domesticated animals. After these come dates on cremated bone from cremations, antler tools or short-life charcoal associated with the process of extraction in flint mines, and short-life material from deposits deliberately placed in pits. In the middle of the range are single fragments of short-life plant remains derived from the postholes of timber buildings, and thus putatively derived from the period during which the structure was in use (Reynolds 1995); samples of bulk peat and other sediments from environmental sequences whose taphonomy can be complex (Walker *et al.* 2001; Lowe and Walker 2000); and disarticulated bones from burial monuments which are probably functionally related with the site, even if they do not necessarily represent primary deposition. Bottom of the pile are samples which may well be residual: disarticulated bones from the upper fills of features; charred plant material from small assemblages sieved from litres of sediment; or organic remains from mixed artefact-bearing levels in caves.

Over the past decade, in Britain, there has been considerable emphasis on the selection of short-life, *single-entity* samples for dating (Ashmore 1999a). Single-entity samples are those which derive from a single organism, such as bones from a single individual, a single cereal grain or hazelnut shell, or a single fragment of waterlogged wood. Their great advantage is that the dating of single fragments eliminates the risk of combining material of different ages in the same sample, and so obtaining a date which may be anomalously old because of the incorporation of residual or reworked material. The submission of such samples for dating on a routine basis has only become feasible since AMS became widely available to archaeologists in the early 1990s. Another advantage of single-entity sampling is that it helps us to ensure that each of the radiocarbon dates included in our model is statistically independent (avoiding potential bias in our results). So, for example, we can select each of our radiocarbon samples from a different individual in a burial assemblage. Such sampling means that we know that each radiocarbon date estimates the time of a different event in the period of past activity in which we are interested (and know which results are replicate measurements on the same person which can be combined before inclusion in the model). The major disadvantage of single-entity sampling is that it is vulnerable to tiny fragments of intrusive or residual material that may be selected for AMS dating, which would form an insignificant proportion of a larger radiometric sample (Lanting and van der Plicht 1994; Prendergast 2000).

The single-entity sampling made possible by AMS has undoubtedly been a major advance in the use of radiocarbon dating in archaeology. It is not, however, a fool-proof strategy and, on its own, it is not enough. Of the 12 categories of sample listed above which we have submitted for dating during this project, only ten are strictly single-entity samples. Carbonised residues on the interior of pottery sherds (categories 4 and 11) are interpreted by us as the remains of burnt food. These residues will, therefore, usually derive from a number of different animals and plants which provided the ingredients for the recipe, and not from a single entity. This does not make them ‘bad samples’, as our archaeological judgement is that most of the ingredients will have been used fresh (and even those that had been preserved by pickling or the like are unlikely to have been

more than a few seasons old before consumption). Once again, it is the taphonomic interpretation of the dated material that is central to our sample selection.

We have carried over this logic in our assessment and modelling of pre-existing dates. For example, dates on bulk samples of short-life charcoal from contexts where the charcoal may be functionally related to the deposit, such as hearths, have been incorporated into models fully, not as *termini post quos* (e.g. *Corylus*; Fig. 5.34). Conversely, just because a date is from a single entity and on short-life material does not mean that it cannot be residual, reworked, or curated and so more appropriately modelled as a *terminus post quem* (e.g. *OxA-1396–7* and *OxA-1400–2*; Fig. 4.51).

2.5.3 From samples to sampling

Having identified a pool of samples suitable for radiocarbon dating, the next step in the process of creating a Bayesian chronology is to select those which should be dated (Fig. 2.20). Here strategy meets pragmatism.

For some sites, particularly those with little existing chronology and/or little datable material, all the available suitable samples were submitted for dating. This included sites such as Orsett (Chapter 7), Banc Du and Hill Croft Field (Chapter 11), where there has been limited excavation, and sites such as Haddenham (Chapter 6), and Helman Tor and Carn Brea (Chapter 10), where the conditions of preservation were such that limited datable material remained in archive. The chronologies we have been able to construct for these sites are generally imprecise, and are probably the least archaeologically reliable of those presented for enclosures in this volume.

For other sites, the pool of suitable datable material was larger and we could choose what to date. There were two guiding principles to our sampling strategy. The first was to maximise the quantity of informative prior information that was included in our models by targeting sequences of stratigraphically-related, non-residual samples for dating. The second was to ensure that these samples were archaeologically representative: chronologically, by selecting samples from the entire vertical sequence in the ditches, and spatially, by sampling at more than one location around a circuit. Replicate samples were often submitted from deposits where the taphonomy of the dated material was more questionable (such as charred plant remains from supposedly primary disposal events). In this case, the statistical consistency of measurements from a deposit, and the good agreement in the model of these dates in relation to those from material with more secure associations from stratigraphically related contexts, might support our original taphonomic interpretation of this dated material as close in age to its context.

But how many samples should be dated? And which sequences would provide the most effective constraints for our models? These questions were answered with the aid of simulation models (Fig. 2.20). The components of a simulation model are those of any model. First the available informative prior beliefs are established, from the model of existing dates and from the stratigraphic matrix of suitable samples. After this, radiocarbon dates can be simulated from the pool of suitable datable material and the appropriate prior information incorporated into the simulation model. Errors on the measurements are estimated from those recently obtained by the selected laboratory on similar material of similar age. In this process the actual date of the site has to be fed into the model, which is done on the basis of our existing understanding of the site chronology. Multiple models can be run for different actual ages and for different sampling strategies to see which approach might be most effective. Some examples of the simulations created during the process of sample selection for the enclosures dated in this project are given in the regional chapters (e.g. Figs 3.7, 4.40 and 5.4).

Often sequential sampling strategies are the most efficient. First, the minimum number of samples which might be able to achieve the archaeological objectives are submitted for dating (assuming that the site falls on the most helpful piece of calibration curve possible). Once these results have been reported and incorporated in the model, further simulated dates are added to the existing dates in a new simulation and the cycle repeats (Fig. 2.20). In practice, it is rarely this simple. Some samples will provide dates which are not in agreement with the prior information included in the model. Sometimes, something will have gone wrong with a radiocarbon measurement in the laboratory, but almost always it is the interpretation of the taphonomy of the dated sample (and therefore its relative chronology within the dated sequence) that will be in error. These problems are identified and the site is re-modelled in an appropriate way. Ideally, we repeat this sampling cycle until adding more simulated dates does not materially improve the precision of the chronology produced by the model (e.g. Maiden Castle, Chapter 4; Abingdon, Chapter 8). Sometimes, however, we simply ran out of suitable samples (e.g. Etton, Chapter 6).

It should be noted that we have not adopted a purely statistical approach to sampling in this study. Such approaches have been suggested (Buck and Christen 1998), but in practice we find that there are so many scientific and archaeological factors affecting the accuracy of radiocarbon dates that these usually outweigh purely statistical criteria. Having said this, projects where the samples are selected around the model, rather than where the model is grafted on to an existing suite of dates, have consistently provided much more precise chronologies and been much more cost-effective (Bayliss and Bronk Ramsey 2004, 26). This approach to sample selection and sampling is time-consuming, but is essential for the production of precise and reliable archaeological chronologies.

2.5.4 Reporting the models

Finally, a model is built which incorporates all the radiocarbon dates and all the archaeological prior information that we have painstakingly identified. Our interpretation of

these data may be straightforward, in which case we simply report our preferred interpretation. Frequently, however, it is useful to provide a series of alternative models, perhaps exploring different readings of the archaeological sequence or different statistical assumptions. These sensitivity analyses provide an indication of the robustness and reliability of the preferred model. They can demonstrate how far our posterior beliefs are changed by different statistical models or archaeological interpretations, and also show which components of a model are most critical in determining those posterior beliefs.

2.6 Laboratory methods

The procedures used for the preparation and dating of samples in the laboratory are critical for accurate radiocarbon dating. In this study, although we have undertaken a substantial number of new measurements on material selected and retrieved from archives during the project, we have also included a much larger number of existing radiocarbon dates. These have been accumulated over the past 60 years by a variety of researchers for a variety of purposes. As described in the previous section, these samples were often selected using different criteria from those employed in this study. They were also prepared and measured in laboratories using a variety of techniques, not all of which are still in use.

Until the mid-1980s all radiocarbon dating was undertaken using conventional, beta-counting techniques. Samples were pre-treated to remove exogenous carbon and then combusted to produce carbon dioxide. This could then be dated by gas proportional counting (GPC).[10] The dataset considered in this volume includes radiocarbon measurements obtained by the GPC of carbon dioxide (8.4%), methane (4.6%), and acetylene (0.7%) (Fig. 2.26). Alternatively, the carbon dioxide produced by combustion could be converted to a carbon-rich liquid, usually benzene, and dated by liquid scintillation spectrometry (LSC).[11] Just over a quarter of the measurements considered in this study were made by the LSC of benzene (25.1%), with a few measurements made at Trinity College, Dublin, during the development stage of the technique being made by the LSC of methanol (0.3%) (Fig. 2.26). The major disadvantage of conventional radiocarbon dating was the very large sample size required (Fig. 2.25). This limited not only the samples that could be dated, but the types of material that could be dated. From the mid-1980s radiocarbon dating by accelerator mass spectrometry (AMS)[12] became available to archaeologists, although initially the technique was less precise and more costly than conventional dating. Because it measures the radiocarbon atoms in a sample directly, much smaller samples are required (Fig. 2.25). Samples are pre-treated, combusted to carbon dioxide and then converted to graphite before dating in the accelerator. Sometimes carbon dioxide can be introduced directly into the accelerator, omitting the graphitisation stage. The majority of measurements considered in this volume were undertaken by AMS (60.7%) (Fig. 2.26). A general introduction to the laboratory techniques of radiocarbon measurement can be found in Bayliss *et al.* (2004).

Chemical pre-treatment techniques for removing contaminants before a sample is combusted have also evolved over the past decades. These approaches are strongly linked to the types of material dated. Figure 2.27 shows the types of material which provided the measurements detailed in this volume. Samples of charred plant remains (including charcoal) (47.5%) and bone and antler (40.0%) are the most common types of material dated, with smaller numbers of samples coming from carbonised residues on ceramics (5.1%) and cremated bone (1.8%). These types of material can only be dated by AMS. Samples of waterlogged plant remains (5.3%), bulk sediment (3.0%) and marine shell (0.1%) make up the remainder of the dataset.

Since the 1950s the most common method used for the chemical pre-treatment of charred and waterlogged plant material has been the acid/alkali/acid (AAA) protocol (Mook and Waterbolk 1985), which has proved routinely effective (at least for samples of Holocene age). Approaches to dating bulk sediment are usually also based on this method, although either the acid insoluble/alkali soluble ('humic acid') fraction or the alkali/acid insoluble ('humin') fraction of the sample can be dated. Sometimes both of these fractions are combined and the 'total organic carbon' fraction is dated. More rarely, the sample is simply given an acid wash and the solid residue is dated. Shore *et al.* (1995) provide a useful overview of approaches to dating bulk sediment. Where we have been able to trace this information, details of the fraction dated for sediment samples are provided in the tables in this volume. Similarly based on the AAA protocol are approaches to dating carbonised residues on pottery. This technique has a much shorter history, but again both acid insoluble/alkali soluble and alkali/acid insoluble fractions have been shown to provide accurate dates (Hedges *et al.* 1992a).

Bone and antler have consistently proven a challenging sample type. The most reliable dates on unburnt bone are provided by the protein fraction. Although there were attempts to extract this in the 1960s (e.g. Berger *et al*. 1964; Haynes 1967), the collagen extraction protocol suggested by Longin (1971) was a major advance. This method was swiftly adopted by most radiocarbon laboratories around the world and, in its original or variant forms, is still widely used. It is generally effective in providing accurate dates for material of Holocene age in Britain and Ireland. Many other techniques have been employed for dating bone samples, however, particularly where the bone is poorly preserved, of Pleistocene age, or contaminated by consolidants (T. Brown *et al.* 1988; Law and Hedges 1989; Nelson 1991; Bronk Ramsey *et al.* 2000b; 2004a). With the exception of the flawed ultrafiltration protocol used briefly in Oxford in 2000–2 (Bronk Ramsey *et al.* 2000b), all these methods routinely produce accurate dates on the comparatively well-preserved samples of Neolithic age from Britain and Ireland considered in this study. Most inaccurate dates on bone and antler were undertaken in the 1960s when methods for reliably extracting bone protein were under development

and attempts were made to date the carbonate fraction of unburnt bone; in the 1980s on low-collagen bones when AMS laboratories were establishing the minimum level of protein preservation required for accurate dating; or more generally on burnt or carbonised bone where the protein had been sufficiently denatured for it to be irretrievably contaminated by its burial environment.

Protein does not survive in fully cremated bone, and this type of material was not datable until a new protocol for dating the structural carbonate in calcined bone using AMS was proposed by Lanting *et al.* (2001). This protocol has been widely adopted and provides accurate results (Van Strydonck *et al.* 2005; Naysmith *et al.* 2007).

2.6.1 Methods used for dating the samples submitted during this project

Of the 427 new radiocarbon measurements obtained as part of this project, five high-precision results were produced by the Queen's University Belfast Radiocarbon Dating Laboratory using LSC, 173 measurements were made by AMS at the Oxford Radiocarbon Accelerator Unit, and 249 measurements were made by AMS at the Centrum voor IsotopenOnderzoek at the Rijksuniversiteit Groningen, The Netherlands. All samples were dated between 2004 and 2007.

The profile of dated materials for the new sampling programme (Fig. 2.28) is slightly different from that of the overall dataset (Fig. 2.27). During this project higher proportions of the dated samples were bone and antler (44.5%) and carbonised residues on ceramics (20%), and a smaller proportion charred plant remains and charcoal (33.7%), than in the larger dataset. This reflects the emphasis on archaeological taphonomy for sample selection outlined in section 2.5.2 above. The five samples dated at Belfast by LSC were of bone or antler (Fig. 2.29). The different types of sample were otherwise evenly distributed between the two AMS laboratories, except for charred plant macrofossils. A disproportionate number of samples of this type were dated by the Groningen laboratory because most of the samples from Ireland, the Isle of Man and Wales had to be processed there in early 2006 because of a temporary technical problem at Oxford. This accounts for the slightly larger number of AMS results measured at Groningen.

In Belfast the bone and antler samples were processed according to methods outlined in Longin (1971) and Pearson (1984) and measured by LSC (Noakes *et al.* 1965; McCormac 1992; McCormac *et al.* 1993).

Charred and waterlogged plant remains dated at the Rijksuniversiteit Groningen were processed using the AAA protocol (Mook and Waterbolk 1985); samples of unburnt bone were prepared as described by Longin (1971); carbonised residues on pottery sherds were pre-treated by using the AAA method on the entire sherd and selecting the alkali-soluble fraction for dating (Mook and Streurman 1983). The samples were then combusted to carbon dioxide and graphitised as described by Aerts-Bijma *et al.* (1997; 2001) and dated by AMS (van der Plicht *et al.* 2000).

At the Oxford Radiocarbon Accelerator Unit samples of charred and waterlogged plant remains and carbonised residues were prepared using the methods outlined in Brock *et al.* (2010); carbonised residues (and a few samples of charred plant remains) were pre-treated using acid only as they were generally too fragile to withstand the alkali step; unburnt bones were processed using the gelatinisation and ultrafiltration protocols described by Bronk Ramsey *et al.* (2004a). Samples were combusted, graphitised and dated by Accelerator Mass Spectrometry (AMS) as described by Bronk Ramsey *et al.* (2004b). Four samples, OxA-14039–41 from Whitehawk Camp and OxA-14009 from the Trundle (Chapter 5.1 and 5.4), were dated using carbon dioxide targets (Bronk Ramsey and Hedges 1997).

For various technical reasons, a few results from both AMS laboratories were reported with reservations. GrA-30197 and GrA-30176, measurements on samples of unburnt bone from Staines (Chapter 8.1), produced anomalously enriched $\delta^{13}C$ values and had very low carbon content which raises concerns about the accuracy of these dates. Three samples processed at Oxford had low yields of carbon, and so produced small targets which gave low currents in the AMS. These results are reported as experimental measurements, distinguished by the laboratory code 'OxA-X'. The samples were carbonised residues from Maiden Castle (OxA-X-2135-46; Chapter 4.3) and Raddon (OxA-X-2165-10; Chapter 10.3), and a fragment of burnt plank from Magheraboy (OxA-X-2173-16; Chapter 12.2). These three results should also be interpreted with caution.

2.6.2 Methods used for dating other samples considered in this study

It has been much harder to trace the methods used to date the 1923 measurements considered in this study which we inherited from previous workers. These determinations come from 35 radiocarbon laboratories (Fig. 2.30) and were dated over a period of more than 50 years. This means that not only were different methods used in different laboratories, but laboratories that provided measurements over an extended period also produced results using a variety of methods. We have attempted to trace these differences as far as possible, using laboratory numbers as a guide to when measurements were produced. In this section we provide a general guide to the methods used. Detailed references to the methods appropriate for particular samples are given in Chapters 3–12 and 14 when the results are discussed. For laboratories which produced datelists regularly during the period when they were in operation, tracing the methods used to measure particular samples has been relatively simple. It has been much more difficult to trace methods for other laboratories, where statements of the methods used, usually part of laboratory datelists, were only produced in the first years of a laboratory's operation. On the whole, methods in such facilities probably remained largely unchanged in later years, although this is sometimes hard to demonstrate unequivocally.

Overall, 318 measurements in this dataset (17%) were

produced by Gas Proportional Counting in 18 different laboratories (Fig. 2.30). This reflects the popularity of GPC in the first two decades of radiocarbon dating when laboratories produced very low numbers of measurements. The methods used for dating these samples are summarised in Table 2.1. Some of the ages produced in the Smithsonian Institution (see Chapter 12) and in the early years of the miniature gas counter at Harwell (see Table 2.1, fn 1) appear to be anomalously young. This is noted in the text where appropriate.

More than 600 radiocarbon determinations in the dataset (32%) were produced by Liquid Scintillation Counting in 11 laboratories. The methods used for dating these samples are summarized in Table 2.2 (and see section 2.6.1 above for details of measurements produced at Queen's University, Belfast as part of this study). Some of the ages produced at Trinity College, Dublin, Ireland (D-), during the pioneering era of LSC appear to be anomalously young (see Chapter 12). The laboratory problem at the British Museum in 1980–4 and the thorough measures taken to address it are fully reported by Bowman *et al.* (1990).

Two laboratories, Beta Analytic, USA (Beta-), and the University of Waikato, New Zealand (Wk-), undertake both conventional dating by LSC of benzene and prepare graphite targets for AMS dating (during the period of this study both laboratories sent these targets to a variety of other AMS laboratories for measurement). In both cases, both AMS and conventional measurements are reported with the same laboratory code. Unfortunately, although the laboratories concerned always specify precisely how each measurement was made when reporting results, these details are often not published by archaeologists. Where we have been able to trace this information, it is provided, although often the measurement technique can only be inferred from the type of material dated.

Slightly under 1000 AMS measurements are included in this dataset (52%). All of these results have been produced since 1980, and the vast majority of them have been produced in the last 15 years. The Oxford Radiocarbon Accelerator Unit (OxA-) accounts for 62% of the AMS measurements considered, with the remaining 38% deriving from 11 other laboratories (Fig. 2.30). The methods used for dating these samples are summarised in Table 2.3. Results on bone and antler with laboratory numbers in the ranges OxA-9361 to OxA-11851 and OxA-11214 to OxA-11236 should be interpreted with caution as a technical issue with the bone preparation method used at Oxford for these samples led to some results on this material being anomalously old (Bronk Ramsey *et al.* 2004a).

2.7. Accuracy

The overwhelming majority of radiocarbon dates that do not provide accurate estimates for the date of archaeological interest are inaccurate because inadequate attention has been paid by archaeologists to the association between the dated material, the context from which it was recovered, and the target event that we wish to date (see section 2.5.2 above). This is illustrated by Fig. 2.15, which shows that 511 of the 1782 radiocarbon dates included in at least one of the Bayesian models in this study can only be included in the models as *termini post quos*. These samples – unidentified charcoal, charcoal from long-lived wood species, disarticulated bones or plant macrofossils that are not functionally related to the contexts from which they were recovered – represent 28.7% of the data in our models. In other words, almost one in three of the radiocarbon dates considered in this volume are anomalously old because archaeologists selected their radiocarbon samples unwisely. This is particularly disappointing as more than 80% of the radiocarbon dates concerned have been produced since the importance of the archaeological associations of radiocarbon samples was first highlighted (Waterbolk 1971).

Almost all radiocarbon laboratories worldwide have voluntarily, and at their own expense, participated in a continuing series of international inter-comparison exercises over the past 30 years. These studies cover the period during which about three quarters of the measurements included in this study were made. The results of these inter-comparisons are published (International Study Group 1982; Scott *et al.* 1990; Rozanski *et al.* 1992; Scott 2003) and the results are used by the participating laboratories to identify and resolve technical problems with their sample processing and measurement systems. Although an extremely useful means of cross-checking results between laboratories, these formal, international inter-comparisons form only part of the on-going quality assurance procedures which laboratories undertake. Commonly these include not only the measurement of internationally agreed standard materials, but also the dating of known-age tree-rings (see, for example, Bronk Ramsey *et al.* 2002).

These formal international inter-comparison studies grew out of a long-standing concern with the accuracy and reproducibility of radiocarbon measurements. Groups of radiocarbon laboratories had been exchanging and dating known-age material since the 1950s (e.g. Willis *et al.* 1960), and much effort had gone into the establishment of internationally agreed standard materials (Olsson 1970; Polach 1972; Mann 1983). As the need for the calibration of radiocarbon dates became apparent during the 1960s (Suess 1967) and as tree-ring calibration became available during the 1970s and 1980s (e.g. Ralph *et al.* 1973; Stuiver and Pearson 1986; Pearson and Stuiver 1986; Pearson *et al.* 1986), issues of accuracy and reproducibility became more pressing (R. Clark 1975; Baillie 1990). There were also now, particularly after the advent of AMS, many more laboratories producing dates. In the late 1970s, the British laboratories then in operation participated in a formal inter-comparison study (Otlet *et al.* 1980), which was followed by the formal international inter-comparison exercises which continue today.

2.7.1 Replicate measurements

One method of assessing the reproducibility of radiocarbon results is to consider groups of replicate measurements

Table 2.1. Methods used to produce measurements considered in this study which were dated by Gas Proportional Counting.

Laboratory	**Laboratory code**	**Counting gas**	**Methods**
Louvain-la-Neuve, Belgium	Lv-	methane	Samples were pretreated using the AAA protocol, except for bones which underwent a modified Longin protocol which included an alkali step (Gilot 1997, 7–10), and dated as described by Dossin *et al.* (1962).
Smithsonian Institution, USA	SI-	methane	Samples were pretreated using acid and alkali; no fractionation correction was applied (Stuckenrath and Mielke 1972; 1973).
Cardiff University, later Swansea University	CAR- SWAN-	methane	Samples were pretreated either using the AAA protocol or (for bones) a modified Longin protocol which included an alkali step (Dresser 1985). The results quoted were conventional radiocarbon ages.
University of Birmingham	Birm-	methane	Samples were pretreated either using the AAA protocol or (for bones) a modified Longin protocol which included an alkali step (Shotton *et al.* 1967; Williams and Johnson 1976).
Queen's University, Belfast	up to UB-2560	methane	Samples were processed and dated as described by A. Smith *et al.* (1970).
Gakashuin University, Japan	GaK-	acetylene	Samples were processed and dated as described by Kigoshi and Endo (1962; 1963).
British Museum	BM-150 and below	acetylene	Measurements made at the British Museum before 1968 (in this study BM-150 and below) were made using GPC of acetylene (Barker 1953; Barker and Mackey 1959). Samples were pretreated using the AAA protocol, except for bones where the organic fraction was extracted using acid only. Ages were not corrected for fractionation, although the reported error includes ±80 for fractionation and ±100 for the 'de Vries effect' in addition to the counting errors (Barker and Mackey 1961).
Gif sur Yvette, France	Gif-	carbon dioxide	Samples were processed and dated as described by Delibrias *et al.* (1972).
Pretoria, South Africa	Pta-	carbon dioxide	The measurement is a conventional radiocarbon age produced as described by Vogel and Waterbolk (1967), Vogel and Marais (1971) and Vogel *et al.* (1986).
Lund, Sweden	Lu-	carbon dioxide	Samples were processed and dated as described by Östlund (1957) and Håkansson (1968).
Stockholm, Sweden	St-	carbon dioxide	Conventional radiocarbon ages were produced using methods described by Östlund (1959) and Östlund and Engstrand (1963).
National Physics Laboratory, Teddington	NPL-	carbon dioxide	Samples were pretreated using acid and alkali and dated as described by Callow *et al.* (1963). These results were corrected for fractionation and the error term included an allowance of ±80 for the 'de Vries effect'.
Teledyne Isotopes, USA	I-	carbon dioxide	Samples were dated as described by Trautman and Willis (1966). The reported ages are not corrected for fractionation, although $\delta^{13}C$ values were measured (Buckley and Willis 1970). Bones were prepared using the method described by Berger *et al.* (1964) as modified by Haynes (1967).
Gliwice, Poland	Gd-	carbon dioxide	Samples were pretreated as described by Olsson (1979), combusted and purified as described by M. Pazdur *et al.* (1979), and dated as outlined in A. Pazdur *et al.* (1982).
Rijksuniversiteit Groningen, The Netherlands	GrN-	carbon dioxide	Samples were processed and dated as described by Mook and Streurman (1983).
British Museum	BM-170–214	carbon dioxide	A small number of measurements were made by GPC of carbon dioxide at the British Museum in 1968 (in this study BM-170–214) (Barker and Mackey 1968).
Godwin laboratory, Cambridge	Q-676 and below	carbon dioxide	Samples dated in the first decades of operation of the laboratory (in this study Q-676 and below) were dated as described by Switsur *et al.* (1970), Switsur and West (1973; 1975) and Switsur (1981).
AERE Harwell	Selected HAR-numbers	carbon dioxide	In the mid-1980s, 26 samples included in this study were dated by GPC of carbon dioxide using the miniature gas counter at AERE Harwell.[1] These samples were pre-treated and dated as described by Otlet and Warchal (1978), Otlet and Evans (1983), and Otlet *et al.* (1983; 1986).

[1] HAR-2041, -2369–72, -2377–8, -4438, -6037–8 and -9166–9 from Hambledon Hill, HAR-4110, -5125, -5216a–b and -5271 from Briar Hill, HAR-8903–4 from Haddenham, HAR-6477–8 from Drayton, and HAR-5246, -8083, -8544 and -941 from Rowden, Druid Stoke, Tiverton and Alfriston respectively.

Table 2.2. Methods used to produce measurements considered in this study which were dated by Liquid Scintillation Counting.

Laboratory	**Laboratory code**	**Counting liquid**	**Methods**
Trinity College, Dublin, Ireland	D-	methanol	This laboratory was operational for a short period during the late 1950s. Samples were pretreated by the AAA protocol, synthesised to methanol as described by Delaney and McAulay 1959, and dated as described by Cummins *et al*. (1960) and McAulay and Watts (1961).
University of Lyon, France	Ly-	benzene	The bone sample was prepared as described by Longin (1971) and dated by LSC of benzene (Evin *et al.* 1983).
NERC Radiocarbon Laboratory	SRR-	benzene	The measurements are conventional radiocarbon ages and were dated as described by Harkness and Wilson (1972; 1973).
Scottish Universities Research and Reactor Centre	GU-	benzene	Samples were prepared as outlined in Stenhouse and Baxter (1983) and dated as described by Noakes *et al.* (1965).
University College, Dublin, Ireland	UCD-	benzene	Samples were processed and dated as described by O'Donnell (1997) and Caulfield *et al.* (1998).
Godwin laboratory, Cambridge	Q-2634 and above	benzene	Results from this laboratory during the latter part of its period of operation (in this study Q-2634 and above) were produced as outlined in Switsur (1994).
Queen's University, Belfast	UB-3058–6315	benzene	Results between these laboratory numbers were produced as described by Pearson (1984)
British Museum	BM-	benzene	Radiocarbon determinations reported by the British Museum (BM-) after 1968 were produced as described by H. Barker *et al.* (1969a; 1969b). All ages with laboratory numbers above BM-638 are conventional radiocarbon ages, corrected for fractionation (H. Barker *et al.* 1971). Techniques were developed during the later period of the laboratory's operation and measurements with laboratory numbers above BM-2400 were dated as described by Ambers *et al.* (1987). A technical problem in this laboratory between 1980 and 1984 meant that results were systematically too young (Bowman *et al.* 1990). Many of these samples were re-dated, although others were recalculated. These are denoted with the laboratory suffix 'R' (e.g. BM-2283R, Chapter 4).
AERE Harwell	HAR-	benzene	All samples included in this study, except those listed in Table 2.1, were prepared and dated as described by Otlet (1977; 1979), Otlet and Warchal (1978) and Tamers (1965).
Beta Analytic Inc, USA	Beta-	benzene	All samples are prepared and dated as described at http://www.radiocarbon.com.
University of Waikato, New Zealand	Wk-	benzene	Details of the methods used to prepare and date these samples are provided by Hogg *et al.* (1987), Higham and Hogg (1997) and Petchey and Higham (2000).

Table 2.3. Methods used to produce measurements considered in this study which were dated by Accelerator Mass Spectrometry.

Laboratory	**Laboratory code**	**Methods**
Beta Analytic Inc, USA	Beta-	All samples are prepared and dated as described at http://www.radiocarbon.com.
University of Waikato, New Zealand	Wk-	All samples are prepared and dated as described at http://www.radiocarbondating.com.
Queen's University, Belfast	UB-6407–UB-7596 (in this study)	A small number of samples were prepared and graphitised at the Queen's University, Belfast (Mook and Waterbolk 1985; Longin 1971; Slota *et al.* 1987) and then dated at the Oxford Radiocarbon Accelerator Unit (Bronk Ramsey *et al.* 2004b). Quoted $\delta^{13}C$ values were measured by AMS.
Queen's University, Belfast	UBA-	Samples are prepared and graphitised as described by Mook and Waterbolk (1985), Longin (1971), and Slota *et al.* (1987) and dated as described at http://www.chrono.qub.ac.uk.
Scottish Universities Research and Reactor Centre	AA- (in this study)	Samples were pretreated and graphitised at the Scottish Universities Research and Reactor Centre using methods described by Stenhouse and Baxter (1983) and Slota *et al.* (1987), and measured by AMS at the NSF-Arizona AMS facility as described by Donahue *et al.* (1997).
Scottish Universities Environmental Research Centre	SUERC-	Samples were pretreated as described by Stenhouse and Baxter (1983), graphitised using methods described by Vandeputte *et al.* (1996), and dated by AMS (Xu *et al.* 2004; Freeman *et al.* 2007).
Rijksuniversiteit Groningen, The Netherlands	GrA-	Methods are described in section 2.6.1, but note additionally that cremated bone samples were pretreated as described by Lanting *et al*. (2001).
Uppsala, Sweden	Ua-	Samples were prepared as described by Wohlfarth and Possnert (2000), graphitised as described by Vogel *et al.* (1984), and dated by AMS (Possnert 1984; 1990).
Rafter Radiocarbon, New Zealand	NZA-	Samples were pretreated by the AAA method (Mook and Waterbolk 1985), except for unburnt bone which was pretreated as described by Longin (1971) and cremated bone which was prepared as described by Lanting *et al.* (2001). Samples were graphitised as described by Slota *et al.* (1987) and dated by AMS (Zondervan *et al.* 2007).
Leibniz-Labor, Christian Albrechts Universität, Kiel, Germany	KIA-	Samples were pretreated as described by Grootes *et al.* (2004) and graphitised and dated as described by Nadeau *et al.* (1997; 1998). Quoted $\delta^{13}C$ values are measured by AMS.
Posnań Radiocarbon Laboratory, Poland	Poz-	Samples were pretreated as described by Mook and Waterbolk (1985), combusted and graphitised as described by Czernik and Goslar (2001), and dated by AMS (Goslar *et al.* 2004). Quoted $\delta^{13}C$ values are measured by AMS.
Center for Accelerator Mass Spectrometry, Lawrence Livermore National Laboratory, USA	CAMS-	The samples were prepared and dated as described by Vogel *et al.* (1987), Southon and Roberts (2000), and Fallon *et al.* (2007).
Oxford Radiocarbon Accelerator Unit	OxA-	The first dates on archaeological material were produced by this facility in the early 1980s, and since that time results have been produced continuously, using a variety of methods and three AMS machines. The pretreatment methods for charred and waterlogged plant material, sediments, charred residues on pottery, and cremated bones are described by Brock *et al.* (2010). With the exception of the latter, which is based on the protocol of Lanting *et al.* (2001), these pretreatments are variants of the AAA protocol. Until *c.* 2006 the alkali step may have been omitted for fragile samples of charred plant remains, and until *c.* 2004 an alkali step was sometimes used on charred residues on pottery (Hedges *et al.* 1992a). A final bleaching step may have also been used for non-charred plant material (Hedges *et al.* 1989a; Wand *et al.* 1984), and additional protocols may have been adopted for samples contaminated with preservatives and the like.

		It is bone pre-treatment methods that have most varied over the years. Early on bone and antler samples were prepared as described by Gillespie *et al.* (1984b; 1986). There then followed a period when the extracted protein was purified using ion exchange (Hedges and Law 1989; Law and Hedges 1989). From OxA-7000 this method was abandoned and protein was extracted as described by Bronk Ramsey *et al.* (2000a). Samples with laboratory numbers within the ranges OxA-9361 to OxA-11851 and OxA-11214 to OxA-11236 were prepared using the gelatinisation and ultrafiltration protocol described by Bronk Ramsey *et al.* (2000b). More recent samples have been prepared following the revised ultrafiltration protocol described by Bronk Ramsey *et al.* (2004a) (and see also Brock *et al.* 2007a; 2010). Further details of the pretreatment methods used for particular samples are given in the following chapters where the interpretation of these results is considered. Following appropriate pre-treatment, samples are combusted to produce carbon dioxide (Hedges *et al.* 1992b). For samples with laboratory numbers below OxA-6293, this was placed into the carbon dioxide ion source in the AMS and dated (Gillespie *et al.* 1983; R. Hedges 1981). This gas ion source was a major focus of the laboratory's technical research during the 1980s (Bronk and Hedges 1987; 1989; 1990). Samples with laboratory numbers between OxA-6293 and OxA-11738 were dated in the second AMS machine at Oxford. This used the hybrid carbon dioxide and graphite ion source described by Bronk Ramsey and Hedges (1997). Increasingly samples were graphitised (Dee and Bronk Ramsey 2000), with only samples which yielded very little carbon being run as carbon dioxide targets. From OxA-11739 samples were dated using the current AMS machine at Oxford (Bronk Ramsey *et al.* 2004b).

made on the same material. The 88 groups of replicate measurements considered in this study are listed in Table 2.4. Thirty-eight of these replicate groups were obtained from enclosures during the course of this study, eight further groups were produced during this study by obtaining repeat measurements on samples for which determinations were already available, and 42 groups of replicates were available from previous studies (although 18 of these are from the early Neolithic complex on Hambledon Hill). The large sample size needed for conventional dating (Fig. 2.25) meant that the number of replicate measurements made on archaeological samples was severely constrained by the availability of sufficient material until the advent of AMS. Additional material was often only made available if there was perceived to be a problem with the original measurement.

Since radiocarbon ages have errors which are normally distributed, the consistency of replicate measurements can be tested using the χ^2 test (Shennan 1988, chapter 6; Ward and Wilson 1978). If all our radiocarbon ages are perfectly accurate and all the uncertainties on the measurements have been estimated perfectly, we expect the actual radiocarbon content of one in 20 radiocarbon ages to lie outside the quoted determination at two standard deviations. We therefore expect that four or five replicate groups will fail to pass a χ^2 test simply on statistical grounds. In fact 16 groups of measurements fail to pass the test (Table 2.4), which is significantly more than expected (T'=48.2; T'(5%)=12.6; ν=6). Overall, bone and antler samples and samples of carbonised residues on pottery sherds produce inconsistent results more often than expected (Table 2.5). If we consider only the 38 replicate groups produced as part of this study, again more groups of measurements are statistically inconsistent than would be expected simply on statistical grounds (T'=29.6; T'(5%)=6.0; ν=2). In this case, however, bone and antler samples produced inconsistent results only as often as expected, although carbonised residues again produce inconsistent results more often than expected (Table 2.5).

Since the bone and antler samples dated as part of this project were dated by three different methods (see section 2.6.1 above), the consistency of the replicate groups measured as part of this study is striking. Although more sophisticated techniques may be required for dating poorly preserved bone samples or those dating to the Pleistocene (Higham *et al.* 2006), it is apparent that results produced using methods outlined by Longin (1971) and by gelatinisation and ultrafiltration (Bronk Ramsey *et al.* 2004a) are reproducible for the types of sample dated as part of this study.

Of the six inconsistent replicate groups of measurements on bone and antler samples which include measurements undertaken before this study, four were undertaken specifically because there was thought to be a technical problem with the initial measurement (group 41, Sharples 1991a, 104–5; group 68, Jordan *et al.* 1994, 4; group 72, Chapter 6.4; group 82, Chapter 8.4). These replicates do not therefore represent a random sample of the radiocarbon

Table 2.4. Replicate radiocarbon measurements (a) produced during this study, (b) produced during this study on previously dated samples, and (c) existing prior to this study. T' values for groups which are significantly different (at 95% confidence) are in bold.

Site	Material	Laboratory Number	Radiocarbon Age (BP)	χ^2 test (Ward and Wilson 1978)	Replicate Group
Replicate groups obtained during the course of this study					
Windmill Hill (Table 3.2)	Carbonised residue	OxA-13732	4672±45	**T'=21.4**; T'(5%)=3.8; ν=1	1
		GrA-25391	4360±50		
Windmill Hill (Table 3.2)	Antler	UB-6186	4699±20	T'=5.2; T'(5%)=9.5; ν=4	2
		OxA-15075	4717±30		
		OxA-15076	4673±30		
		OxA-15088	4770±33		
		GrA-29706	4700±40		
Windmill Hill (Table 3.2)	Bone	OxA-13814	4807±32	T'=2.9; T'(5%)= 3.8; ν=1	3
		OxA-14967	4729±33		
Windmill Hill (Table 3.2)	Bone	GrA-25368	3558±26	**T'=4.7**; T'(5%) =3.8); ν=1	4
		OxA-13730	3524±30		
Windmill Hill (Table 3.2)	Bone	OxA-14966	4521±35	T'=3.1; T'(5%)=3.8; ν=1	5
		GrA-29711	4615±40		
Windmill Hill (Table 3.2)	Carbonised residue	OxA-13561	2770±40	**T'=391.2**; T'(5%)=6.0; ν=2	6
		GrA-25389	4050±150		
		GrA-25821	3980±50		
Windmill Hill (Table 3.2)	Bone	GrA-25367	3640±50	T'=1.8; T'(5%)=3.8; ν=1	7
		OxA-13759	3716±28		
Knap Hill (Table 3.3)	Bone	OxA-15200	4699±37	T'=1.1; T'(5%)=3.8; ν=1	8
		GrA-29809	4755±40		
Whitesheet Hill (Table 4.7)	Bone	OxA-15291	4768±33	T'=0.3; T'(5%)=3.8; ν=1)	9
		GrA-30071	4800±45		
Maiden Castle (Table 4.9)	Carbonised residue	GrA-29209	4910±45	T'=1.65; T'(5%)=3.8; ν=1	10
		OxA-14733	4980±32		
Maiden Castle (Table 4.9)	Carbonised residue	GrA-29207	4935±45	T'=3.6; T'(5%)=3.8; ν=1	11
		OxA-14734	4830±33		
Maiden Castle (Table 4.9)	Carbonised residue	GrA-29213	4605±40	**T'=17.2**; T'(5%)=3.8; ν=1	12
		OxA-14793	4870±50		
Whitehawk (Table 5.2)	Antler	GrA-26962	4715±35	T'=1.6; T'(5%)=3.8; ν=1	13
		OxA-14126	4774±31		

Whitehawk (Table 5.2)	Bone	GrA-26966	4605±40	**T'=6.2**; T'(5%)=3.8; ν=1	14
		OxA-14061	4739±36		
Whitehawk (Table 5.2)	Bone	GrA-32365	4780±35	T'=0.7; T'(5%)=3.8; ν=1	15
		OxA-16287	4822±34		
Whitehawk (Table 5.2)	Bone	GrA-32364	4785±35	T'=0.0; T'(5%)=3.8; ν=1	16
		OxA-16286	4790±35		
Whitehawk (Table 5.2)	Bone	OxA-14178	4755±32	T'=0.0; T'(5%)=3.8; ν=1	17
		GrA-27330	4760±45		
Whitehawk (Table 5.2)	Bone	GrA-26977	4785±40	T'=0.0; T'(5%)=3.8; ν=1	18
		OxA-14063	4792±33		
Whitehawk (Table 5.2)	Carbonised residue	GrA-26976	4710±45	T'=0.6; T'(5%)=3.8; ν=1	19
		OxA-14041	4820±130		
Whitehawk (Table 5.2)	Bone	OxA-14062	4785±35	T'=1.3; T'(5%)=3.8; ν=1	20
		GrA-29363	4720±45		
Whitehawk (Table 5.2)	Antler	GrA-29364	4720±45	T'=1.5; T'(5%)=3.8; ν=1	21
		OxA-14065	4650±35		
Whitehawk (Table 5.2)	Antler	GrA-26973	4410±35	T'=0.2; T'(5%)=3.8; ν=1	22
		OxA-14064	4389±32		
Offham Hill (Table 5.3)	Bone	OxA-14177	4722±32	T'=2.5; T'(5%)=3.8; ν=1	23
		GrA-37322	4685±45		
The Trundle (Table 5.5)	Bone	OxA-13935	2124±28	T'=0.1; T'(5%)=3.8; ν=1	24
		GrA-36819	2135±30		
Etton (Table 6.8)	Carbonised residue	OxA-14972	4300±36	T'=1.9; T'(5%)=3.8; ν=1	25
		GrA-29355	4225±40		
Chalk Hill (Table 7.5)	Carbonised residue	GrA-30888	4825±50	T'=0.6; T'(5%)=6.0; ν=2	26
		OxA-15509	4867±36		
		OxA-17122	4839±31		
Staines (Table 8.1)	Carbonised residue	OxA-15253	3869±27	**T'=205.4**; T'(5%)=3.8; ν=1	27
		GrA-30036	3165±40		
Abingdon (Table 8.5)	Bone	GrA-30942	4780±40	T'=1.0; T'(5%)=3.8; ν=1	28
		OxA-15393	4832±34		
Abingdon (Table 8.5)	Bone	GrA-30934	4760±40	T'=3.3; T'(5%)=3.8; ν=1	29
		OxA-15397	4854±33		

Crickley Hill (Table 9.2)	Bone	OxA-14414	4696±35	T'=1.9; T'(5%)=3.8; ν=1	30
		GrA-27820	4770±40		
Crickley Hill (Table 9.2)	Bone	GrA-27813	4830±170	T'=1.4; T'(5%)=3.8; ν=1	31
		GrA-30368	4625±40		
Crickley Hill (Table 9.2)	Carbonised residue	OxA-15704	4530±45	T'=1.6; T'(5%)= 3.8; ν=1	32
		GrA-31103	4450±45		
Crickley Hill (Table 9.2)	Bone	OxA-14416	4890±32	T'=2.2; T'(5%)=3.8; ν=1	33
		OxA-14417	4823±32		
Crickley Hill (Table 9.2)	Single-entity charred plant remains	OxA-14428	4913±34	T'=0.2; T'=(5%)=3.8; ν=1	34
		OxA-14321	4891±31		
Peak Camp (Table 9.3)	Bone	GrA-30030	4760±40	T'=0.2; T'(5%)=3.8; ν=1	35
		OxA-15284	4782±31		
Raddon (Table 10.2)	Carbonised residue	OxA-X-2165-10	4950±300	T'=0.2; T'(5%)=3.8; ν=1	36
		GrA-31191	4810±40		
Helman Tor (Table 10.3)	Carbonised residue	GrA-31319	4705±35	**T'=9.2**; T'(5%)=3.8; ν=1	37
		OxA-15631	4851±33		
Carn Brea (Table 10.4)	Carbonised residue	OxA-15632	4746±34	T'=0.9; T'(5%)=3.8; ν=1	38
		OxA-15633	4791±33		
Replicate groups obtained by this study by re-dating previously dated samples					
Knap Hill (Table 3.3)	Antler	BM-205	4710±115	**T'=4.6**; T'(5%)=3.8; ν=1	39
		GrA-29808	4975±40		
Maiden Castle (Table 4.9)	Bone	OxA-1148	4810±80	T'=0.8; T'(5%)=3.8; ν=1	40
		OxA-14832	4886±35		
Maiden Castle (Table 4.9)	Bone	GrA-29108	4915±40	**T'=16.2**; T'(5%)=3.8; ν=1	41
		OxA-1144	4550±80		
Etton (Table 6.8)	Bone	BM-2765	4830±33	T'=2.5; T'(5%)=3.8; ν=1	42
		OxA-14969	4809±36		
Etton (Table 6.8)	Waterlogged wood	BM-2890	4820±45	T'=0.8; T'(5%)= 3.8; ν=1	43
		GrA-29358	4765±40		
Donegore (Table 12.1)	Bulk charred plant remains	UB-3067	4728±40	T'=1.0; T'(5%)=6.0; ν=2	44
		GrA-31330	4770±35		
		GrA-31328	4785±45		

Donegore (Table 12.1)	Bulk charred plant remains	GrN-15962	4920±25	**T'=14.8**; T'(5%)=6.0; ν=2	45
		GrA-31321	4790±35		
		GrA-31320	4780±35		
Magheraboy (Table 12.2)	Single-entity charred plant remains	GrA-31961	5085±40	**T'=13.2**; T'(5%)=6.0; ν=2	46
		OxA-X-2173-16	5270±40		
		Beta-186488	5060±70		
Replicate groups available before this study					
Hambledon Hill (Table 4.2)	Bone	OxA-7768	4810±45	T'=0.0; T'(5%)=3.8; ν=1	47
		OxA-7769	4795±50		
Hambledon Hill (Table 4.2)	Bone	OxA-7773	4765±45	T'=0.4; T'(5%)=3.8; ν=1	48
		OxA-7774	4725±40		
Hambledon Hill (Table 4.2)	Bone	OxA-7015	4690±60	T'=0.3; T'(5%)=3.8; ν=1	49
		OxA-7016	4735±60		
Hambledon Hill (Table 4.2)	Bone	OxA-7097	4855±60	T'=0.0; T'(5%)=3.8; ν=1	50
		OxA-7098	4870±40		
Hambledon Hill (Table 4.2)	Bone	OxA-7022	4835±55	T'=2.5; T'(5%)=3.8; ν=1	51
		OxA-7023	4700±65		
Hambledon Hill (Table 4.2)	Bone	OxA-7020	4800±65	T'=0.0; T'(5%)=3.8; ν=1	52
		OxA-7021	4800±65		
Hambledon Hill (Table 4.2)	Bone	OxA-7019	4725±60	T'=1.5; T'(5%)=3.8; ν=1	53
		OxA-7058	4625±55		
Hambledon Hill (Table 4.2)	Bone	OxA-7039	4550±60	T'=0.0; T'(5%)=3.8; ν=1	54
		OxA-7040	4565±60		
Hambledon Hill (Table 4.2)	Bone	OxA-7828	4795±50	T'=2.0; T'(5%)=3.8; ν=1	55
		OxA-7829	4910±65		
Hambledon Hill (Table 4.2)	Bone	OxA-7037	4710±55	T'=0.5; T'(5%)=3.8; ν=1	56
		OxA-7038	4770±60		
Hambledon Hill (Table 4.2)	Antler	UB-4152	4792±20	T'=1.8; T'(5%)=6.0; ν=2	57
		OxA-7042	4735±60		
		OxA-7043	4720±65		
Hambledon Hill (Table 4.2)	Bone	UB-4138	4648±21	**T'=6.6**; T'(5%)=3.8; ν=1	58
		OxA-7041	4485±60		

Hambledon Hill (Table 4.2)	Carbonised residue	OxA-7926	4845±50	**T'=6.9**; T'(5%)=3.8; ν=1	59
		OxA-7844	4685±35		
Hambledon Hill (Table 4.2)	Bone	OxA-7035	4820±55	T'=0.1; T'(5%)=3.8; ν=1	60
		OxA-7036	4845±60		
Hambledon Hill (Table 4.2)	Bone	OxA-7024	4855±60	T'=3.1; T'(5%)=3.8; ν=1	61
		OxA-7025	4685±75		
Hambledon Hill (Table 4.2)	Bone	OxA-7044	4560±55	T'=1.1; T'(5%)=3.8; ν=1	62
		OxA-7045	4645±60		
Hambledon Hill (Table 4.2)	Bone	OxA-7026	4740±42	T'=3.6; T'(5%)=3.8; ν=1	63
		OxA-7059	4660±60		
Hambledon Hill (Table 4.2)	Bone	UB-4311	4710±23	T'=0.0; T'(5%)=3.8; ν=1	64
		OxA-7818	4715±40		
Maiden Castle (Table 4.9)	Bulk charred plant remains	BM-2450	5020±50	T'=0.1; T'(5%)=3.8; ν=1	65
		BM-2450A	5050±60		
Stonehenge cursus (Table 4.13)	Antler	OxA-17953	4716±34	T'=0.2; T'(5%)=3.8; ν=1	66
		OxA-17954	4695±34		
Harrow Hill (Table 5.7)	Bulk charred plant remains	BM-2071R	4900±120	T'=0.5; T'=(5%)=3.8; ν=1	67
		BM-2075R	5020±110		
Alfriston oval barrow (Table 5.7)	Bone	HAR-942	2590±90	**T'=24.6**; T'(5%)=3.8; ν=1	68
		HAR-1811	3190±80		
Briar Hill (Table 6.6)	Bulk charred plant remains	HAR-5216a	4130±150	T'=3.5; T'(5%)=3.8; ν=1	69
		HAR-5216b	4470±100		
Briar Hill (Table 6.6)	Bulk charred plant remains	HAR-2284	3460±120	T'=0.3; T'(5%)=3.8; ν=1	70
		HAR-2389	3540±90		
Raunds long barrow (Table 6.7)	Bone	OxA-5632	4825±65	T'=0.0, T'(5%)=3.8, ν=1)	71
		OxA-5633	4820±80		
Etton (Table 6.8)	Bone	OxA-1031	1440±100	**T'=174.3**; T'(5%)=6.0; ν=2	72
		OxA-1313	3040±80		
		OxA-1314	3050±80		
Etton (Table 6.8)	Antler	OxA-1311	3080±80	T'=0.4; T'(5%)=3.8; ν=1	73
		OxA-1312	3020±60		
St Osyth (Table 7.1)	Carbonised residue	OxA-13008	4745±33	T'=0.0; T'(5%)=3.8; ν=1	74
		GrA-25022	4740±45		

Coldrum (Table 7.7)	Bone	OxA-13718	5089±38	T'=2.5; T'(5%)=3.8; ν=1	75
		OxA-13735	5012±31		
Coldrum (Table 7.7)	Bone	OxA-13719	4599±38	T'=0.5; T'(5%)=3.8; ν=1	76
		OxA-13738	4632±30		
Coldrum (Table 7.7)	Bone	OxA-13720	4709±37	T'=2.7; T'(5%)=3.8; ν=1	77
		OxA-13741	4786±29		
Coldrum (Table 7.7)	Bone	OxA-13721	5000±38	T'=2.2; T'(5%)=3.8; ν=1	78
		OxA-13743	5072±30		
Horton (Table 8.3)	Waterlogged wood	BM-2797	4390±100	T'=0.1; T'(5%)=3.8; ν=1)	79
		BM-2816	4355±37		
Yarnton (Table 8.6)	Carbonised 'bread'	NZA-8679	4672±57	T'=0.0; T'(5%)=3.8; ν=1	80
		OxA-6412	4675±70		
Yarnton (Table 8.6)	Calcined bone	OxA-14479	4867±35	T'=3.5; T'(5%)=3.8; ν=1	81
		SUERC-5689	4775±35		
Berinsfield (Table 8.6)	Bone	OxA-15748	4738±35	**T'=8.1**; T'(5%)=3.8; ν=1	82
		HAR-4673	4460±90		
Peak Camp (Table 9.3)	Bone	OxA-445	4670±90	T'=1.2; T'(5%)=3.8; ν=1	83
		OxA-446	4810±90		
Ty Isaf (Table 11.4)	Bone	OxA-14249	4545±50	T'=0.0; T'(5%)=3.8; ν=1	84
		OxA-14395	4552±35		
Kishoge (Table 12.3)	Bulk charred plant remains	GrN-26771	5020±40	T'=0.2; T'(5%)=3.8; ν=1	85
		GrN-26789	4990±50		
Céide Fields (Table 12.6)	Bulk sediment	GrN-23497	4110±40	T'=0.8; T'(5%)=3.8; ν=1	86
		Gd-6693	4030±80		
Céide Fields (Table 12.6)	Bulk sediment	Gd-7147	3360±50	T'=1.0; T'(5%)=3.8; ν=1	87
		Gd-7148	3290±60		
Belderrig (Table 12.6)	Single-entity charred plant remains	UB-7591	4717±37	T'=0.1 T'(5%)=3.8; ν=1	88
		UBA-7591	4732±30		

Table 2.5. Summary of chi-squared tests for the replicate groups of measurements listed in Table 2.4. T' values for groups which are significantly different (at 95% confidence) are in bold.

	All replicates			**This project only**		
	Groups	**Inconsistent groups (5%)**	**T′**	**Groups**	**Inconsistent groups (5%)**	**T′**
Bone and antler	57	8	**9.3**	24	2	0.5
Calcined bone	1	0	0.6	-	-	
Carbonised residues	15	6	**36.8**	13	5	**29.1**
Waterlogged wood	2	0	0.1	-	-	
Single-entity charred plant remains	4	1	0.1	1	0	0.0
Bulk charred plant remains	7	1	1.2	-	-	
Bulk sediment	2	0	0.1	-	-	
Total	**88**	**16**	**48.2**	**38**	**7**	**29.6**

ages on bone and antler samples which we inherited from previous workers. Consequently, it is unlikely that these replicate results truly reflect the accuracy of radiocarbon dating on bone in previous studies. In practice, rather more than 5%, but probably less than 10%, of the dates on bone and antler which we have inherited from previous workers probably really lie outside the 95% probability range quoted.

In contrast, there are obviously still significant technical issues with the accurate dating of carbonised residues on pottery sherds. Six of the 15 replicate groups of measurements on this material type (40%) did not produce statistically consistent results. Figure 2.31 shows the offset between the pairs of replicates (where there are more than two measurements, each subsequent measurement is compared with the first listed from the sample in Table 2.4). It is apparent that carbonised residues can produce results which are not only statistically inconsistent, but also many hundreds of radiocarbon years different!

As we have seen in section 2.6.1, carbonised residues are subject to different pre-treatment protocols at Oxford and Groningen, and different chemical fractions are selected for dating. Nonetheless, consistent results are produced for nine of the sample groups. Where they differ, Groningen produced more recent measurements in five cases (groups 1, 12, 14, 27 and 37) and Oxford produced a more recent measurement in one (group 6). The intra-laboratory pair from Oxford (group 59) is statistically inconsistent. The intra-laboratory pair from Groningen (part of group 6) is statistically consistent, but almost certainly inaccurate (see section 2.7.2 below). Both pre-treatment methods appear to give accurate ages for some samples, and inaccurate ones for others. This may suggest that it is the composition of the dated residue that accounts for this variation. Some of the replicate measurements on carbonised residues were undertaken because the original date had poor agreement with the developing Bayesian model for a site, so again the replicate groups do not form a random sample of the results on carbonised residues considered in this study. We therefore return to the question of what proportion of radiocarbon ages on carbonised residues may be inaccurate in the next section, once we have taken our archaeological understanding of the dates of these samples into account.

Other sample types appear to present fewer technical difficulties in dating. Although the number of replicate groups is limited, they are consistent within statistical expectation for all other sample types (Table 2.5).

2.7.2 Archaeological prior information

The overall accuracy of radiocarbon dates can also be assessed by their agreement with the archaeological prior information included in the Bayesian models. For this analysis we consider the sample of radiocarbon dates from Neolithic enclosures (n=816). This sample includes 419 measurements obtained by this project, and 397 measurements obtained during previous studies. Each date has been categorised based on how it has been incorporated in the preferred model for the site. These models are explained in detail in Chapters 3–12. Our approach to constructing these chronologies, identifying inaccurate radiocarbon dates and validating the archaeological prior information included in our models, has already been introduced in this chapter.

Table 2.6 provides a summary of how each of the 816 radiocarbon dates from Neolithic enclosures has been included in the preferred model for the site from which it comes. We consider 38 measurements (4.7%) to be inaccurate, either on scientific grounds (for example, the reported dates on bone from Staines, Chapter 8.1) or on archaeological grounds (for example, GrA-25389 and GrA-25821, the statistically consistent determinations on carbonised residue from a plain Bowl at Windmill Hill (Chapter 3.1) which produced a mid-third millennium date). We do not consider these radiocarbon results to be statistical outliers, the one in 20 measurements that lie outside the 95% range, but rather to be inaccurate. They have not been included in the modelling.

Figure 2.32 shows the proportion of dates from Neolithic enclosures on different material types which we consider to be inaccurate on archaeological grounds. Again, carbonised residues prove to be the most problematic sample type, with 16.9% of measurements being judged

Table 2.6. How the radiocarbon dates from Neolithic enclosures have been incorporated in the preferred site-based models (detailed in the captions to Figs 14.2–4), by material type (n=816).

	Modelled	**TPQ**	**Not modelled**	**Inaccurate**
Articulated bone	61	2	9	1
Articulating bone	109	12	9	1
Antler	37	0	10	2
Disarticulated bone	59	47	16	9
Carbonised residues	55	13	21	15
Bulk charred plant remains	31	63	54	10
Single-entity charred plant remains	143	23	27	0
Waterlogged wood	9	0	5	0
Bulk sediment	1	0	0	0
Total	**505**	**160**	**151**	**38**

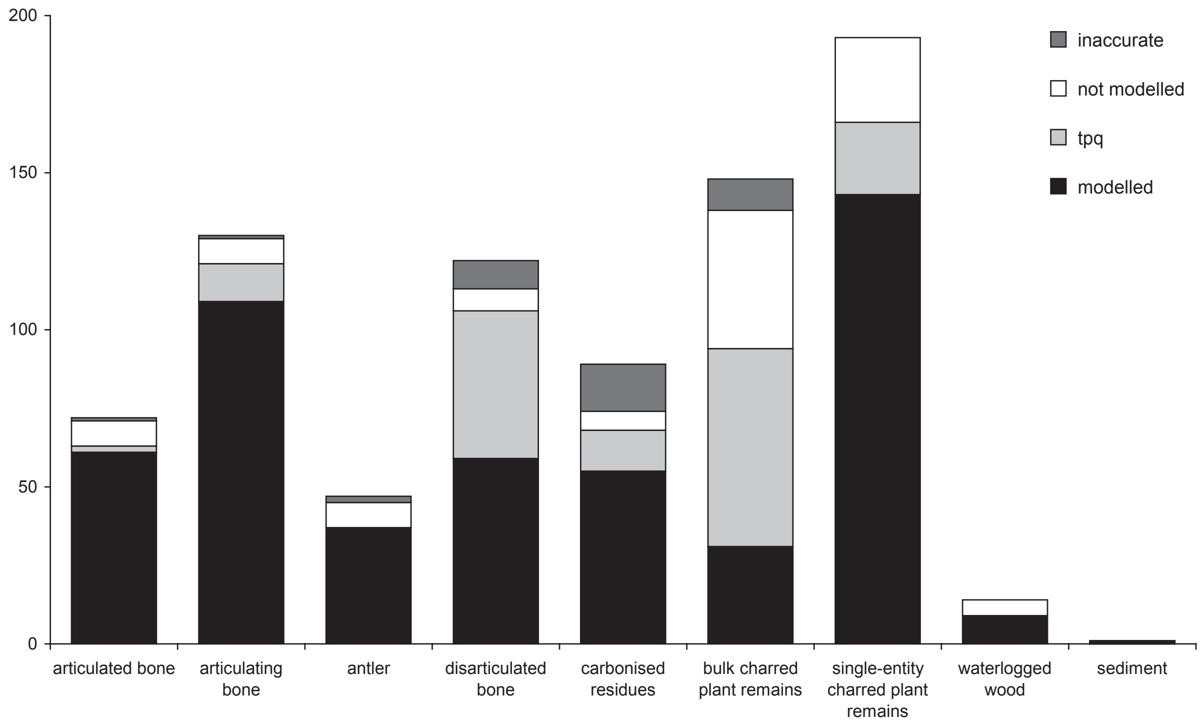


Figure 2.33. How the dates from Neolithic enclosures judged accurate on archaeological grounds (n=778) have been incorporated into the preferred site models (Chapters 3–12), by archaeological material type.

inaccurate. This may be a more reliable indication of the proportion of measurements of this material type which are currently difficult to date accurately, as it derives from the analysis of all 89 measurements from enclosures and is not biased by the preferential selection of problematic results for replication. The proportion of inaccurate measurements on bone is increased by our despairing attempts to date the poorly preserved material from Staines (Chapter 8.1), and that for bulk charred plant remains by initial difficulties with the miniature gas proportional counter at Harwell encountered at Briar Hill (Chapter 6.3).

The next stage in the analysis is to consider how the 778 dates which we have judged on archaeological grounds to be accurate are incorporated into our preferred site models. This analysis assesses the accuracy and effectiveness of different archaeological sample types in dating enclosures. It is summarised in Fig. 2.33. The most effective sample types are articulated and articulating bone groups and antlers functionally related to the contexts from which they come (in this study usually antler tools from the base of ditches). More than 80% of each of these sample types can be incorporated fully into our models. Those that cannot are usually samples such as the child burial in the outer ditch at Windmill Hill (Chapter 3.1) which must have lain in unidentified recuts (and, of course, the burrowing toad at the same site!). Carbonised residues on pottery sherds and single-entity samples of charred plant remains, which are either functionally related to the deposits from which they came or which derive from what are interpreted as primary disposal events, can be fully incorporated into models in more than 70% of cases. In both cases, the fragile

nature of the material concerned may limit opportunities for residuality. The least effective sample types are bulk samples of charred plant remains and disarticulated bone. Less than 25% of dates on bulk samples of charred plant remains can be fully incorporated into our models. Many of these are samples of unidentified charcoal which have been modelled as *termini post quos* because of the potential for the 'old-wood' effect. Just over 50% of dates on disarticulated bone have been incorporated fully in the preferred site models. Most of the others provide *termini post quos* for their contexts. This type of material is robust and can easily be residual or reworked. Because of the special conditions necessary for its preservation, which again limit the potential for residuality, waterlogged wood also seems to be an extremely effective sample type (the samples not included in our models are from later contexts at Etton). The single sediment sample included in this study is fully modelled.

Finally, we consider the effectiveness of our attempts to elicit prior information from sites dug in arbitrary spits (see section 2.4.2 above). We obtained 92 measurements from samples derived from spits at three sites, Windmill Hill (Chapter 3.1), Whitehawk Camp (Chapter 5.1) and Hembury (Chapter 10.2). Of these, 77 (83.7%) could be incorporated into our models. The remaining samples were usually later material from the upper silts, parts of which must have lain in spits which principally included earlier layers.

2.8. Further mathematics

All the modelling in this volume has been undertaken using OxCal v3.10 (Bronk Ramsey 1995; 1998; 2001), and so we have constructed our models from the available range of functions in that software. Without this type of user-friendly software and modular model construction, an application on this scale would simply not have been possible. Nonetheless, it is worth considering the merits and demerits of the types of model that have been available to us during the course of this project, and areas for future development.

First, we consider the use of the uniform distribution. The mathematics of this approach have been available for some time (Buck *et al.* 1992; Nicholls and Jones 2001), and it has proven very forgiving in routine usage (Bayliss *et al.* 2007a, figs 15–17). Archaeologically the major drawback of this approach is the need to define endings. Sometimes this is unproblematic – an LBK longhouse is constructed, used and then destroyed or abandoned – but sometimes reality is not so neat, as a site can be established slowly and decline gradually, or can be used for a period, abandoned, and then reused. Generally, however, it is possible to identify such discrete phases of use archaeologically and the uniform distribution does seem to be appropriate for most site-based studies. In this volume, perhaps only at Windmill Hill is the quantity of later fourth millennium material such that a continuing, if much reduced, presence at the enclosure can be realistically envisaged. This is unusual. Hundreds of chronological models for individual sites have been constructed in England over the past 15 years (Bayliss 2009), and it is rare for a model based on a uniform distribution to be *importantly wrong* (Bayliss *et al.* 2007a).

In Chapters 12 and 14, however, we employ a uniform distribution to model the chronology of the early Neolithic (and elements thereof) in different areas of Britain and Ireland. In this we follow the approach to spatio-temporal modelling suggested by Blackwell and Buck (2003)(and see Buck and Bard 2007). There are two difficulties here. The first is that we wish to estimate the date of the first Neolithic things and practices in each region or area, but these things and practices do not end but rather gradually transform into something else. There is no ending in reality and so we are forced to define an assemblage of Neolithic things and practices which constitute the 'early Neolithic phase' whose chronology we are modelling (see Chapters 12.3–4 and 14.4). The second issue is that we have to define the spatial areas of our analysis. In this volume this is done on an entirely pragmatic basis, regions having been defined around one or more of the enclosures that we have dated. Partially this relates to the distribution of (excavated) enclosures (Fig. 1.2), and partially to topography. There is, for example, some geographical basis for the isolation of Sussex (Chapter 5) or the South-West peninsula (Chapter 10), but very little for the separation of north Wiltshire (Chapter 3) from South Wessex (Chapter 4) or the upper Thames valley (Chapter 8) from the Cotswolds (Chapter 9).

In time, new modelling approaches may be developed to address these issues. Alternative distributions have been proposed for the underlying, real period of activity (Karlsberg 2006; Bronk Ramsey 2009a; 2009b), but in this case they will only alleviate the first issue. We will still need to define endings where archaeologically there are none (although at least the things and practices will be allowed to fade away) and we will still need to define our areas of analysis. Spatio-temporal models that do not model an underlying phase of activity, but rather model the spread of a phenomenon, can also be proposed (Buck 2004, 18–20; Karlsberg 2006; McColl 2008; Nicholls and Nunn submitted[13]). At their most basic, these postulate a centre from which the phenomenon spread and a belief that the phenomenon is more likely to spread to nearby sites than to ones further away. Neither of these beliefs may be appropriate for the spread of the Neolithic across Britain and Ireland. As we will see in Chapter 14.4, there was not necessarily a single focus for the earliest Neolithic in Britain, and if the suggestion that there was an element of long-distance migration in the spread of Neolithic things and practices to Britain and Ireland (Chapter 15.2) is valid, then the belief that there is a simple relationship between distance and the probability of change may also be erroneous. Our analysis also suggests that the pace of the spread of Neolithic things and practices across Britain and Ireland may vary substantially (Chapter 14.8). These complexities in the past call for more complex models than are currently available.

In Chapter 14 we also use the uniform distribution to model the underlying, real period during which certain types of artefact were current. This is also clearly not

ideal. Considerable attention has been given to the popularity curves of artefact types in the archaeological literature, largely in relation to seriation. Brainerd (1951, 304) suggests that seriation is effective when 'each type originates at a given time in a given place, is made gradually in increasing numbers as time goes on, then decreases in popularity until it becomes forgotten, never to reoccur in an identical form'. These uni-modal, but not necessarily normally distributed, popularity curves do appear to be frequently encountered in the occurrence of archaeological types. This has been demonstrated using known-age datasets (Deetz and Dethlefsen 1965, 203; Lyman and Harpole 2002, fig. 8), and indirectly by the number of applications of seriation and correspondence analysis which have successfully identified chronological sequences (Müller 1996, 217). In the pioneering days of Bayesian applications in archaeology, Naylor and Smith (1988, 589) suggested that a beta distribution might be suitable for modelling the production of a type rather than a uniform distribution. More recently, the gradual introduction and demise of archaeological phases have also been modelled using trapezium-shaped prior distributions (Karlsberg 2006, 72–3 and chapter 4). In due course, approaches of this sort may prove more appropriate for modelling the currency of archaeological types.

2.9 Conclusion

Bayesian statistics provide a powerful tool for explicitly modelling archaeological chronologies. The effective implementation of this approach, however, demands much of both archaeologists and radiocarbon laboratories. Archaeologists must establish and unambiguously define their prior information. They must then select their radiocarbon samples wisely. Far greater attention must be given to the critical association between the sample, the context from which it was recovered and the archaeological event that the dating programme targets (section 2.4.2). Sampling strategies must be constructed (section 2.4.3). Then, of course, the samples must be dated with accuracy and reliably estimated precision. Implementing the Bayesian process (section 2.5; Fig. 2.20) is undoubtedly challenging. But it is the means to the kind of chronologies and the kind of narratives (see Chapters 14.1 and 15.13) which we have been able to construct in this volume.

Notes

1 The process of radiocarbon calibration is when a radiocarbon age is converted to a calendar date by means of the calibration curve. Here, we have implemented the process in reverse, converting a calendar date to a radiocarbon age (using the R_Simulate function of OxCal v3.10). In both cases, the methodology takes account of the probabilistic nature of radiocarbon dating (see Fig. 2.16 and section 2.4.3).

2 Between 2006 and 2009 more than 150 archaeologists from the commercial and academic sectors in six countries were asked to estimate the dates of construction and abandonment, and duration of use, of sites from similar simulations to that shown in Figure 2.2 (see also Bayliss *et al.* 2007a, fig. 4; Bayliss 2009, fig. 7; Bayliss and O'Sullivan forthcoming, fig. 1). The vast majority of these archaeologists got the answers *importantly* wrong – 80% estimated the start date to be earlier than that input into the relevant simulation, 87% estimated the end date to be later, and 91% significantly over-estimated the duration!

3 Counting from 1 January 3700 BC to 31 December 3676 BC!

4 The ranges of these estimates do *not* tell us anything about how long it took for the enclosure to be built or for the pottery type to rise to popularity.

5 It should be noted that for many of these sites we actually have samples which seem to be directly associated with the construction event – antler picks from the base of the enclosure ditches. In these circumstances there will be a higher probability that we actually have a radiocarbon measurement which directly relates to the start of activity on the site. It should be noted that it has not been possible to associate radiocarbon dates specifically with boundary events in this study, although this refinement is now possible within OxCal v4 (Bronk Ramsey 2009a, 345).

6 This means that there is a 2 out of 5 chance that sample *d* is earlier than sample *e*, and conversely a 3 out of 5 chance that sample *e* is earlier than sample *d*. This is not much better than tossing a coin (in which case both alternatives would have a chance of 2.5 out of 5, or 1 in 2), so in this case we really do not know which sample came first.

7 Although there are checks to ensure that the prior beliefs and likelihoods input into a model are not mutually contradictory (see below, Chapter 2.4.3).

8 Only 160 (24%) of the 665 radiocarbon dates included in the enclosure models, however, have been incorporated as *termini post quos*. This reflects the corpus of new dates on samples chosen according to the criteria laid out in Chapter 2.5.

9 This means that a smaller number of radiocarbon dates with fewer stratigraphic relationships will produce more precision on steep or wiggly parts of the calibration curve than on plateaux. We do not agree with Ashmore (2004a, 130), however, that precise dating is impossible in the later fourth millennium because of the plateau – we simply need to target situations with highly informative archaeological sequences (be they stratigraphic or typological).

10 The counting gas is held under pressure and a high voltage is introduced between the central wire in the counting chamber and the counter wall. The electron produced by the decay of a radiocarbon nucleus creates an ionisation trail and an avalanche of electrons, which are measured as an electrical pulse.

11 A scintillant is dissolved in the counting liquid and produces a photon of light when an electron is emitted by the decay of a radiocarbon nucleus. These flashes of light are counted using photo-multiplier tubes.

12 In the AMS the carbon in the sample is turned into charged ions which are accelerated to high velocities by strong electro-magnetic fields and then bent by a series of strong magnets according to their mass and charge. This allows the radiocarbon ions to be separated from other ions and counted using an ionisation chamber.

13 Other formal approaches to spatio-temporal modelling have also been suggested (e.g. Davison *et al.* 2006; Dolukhanov *et al.* 2009; Steele 2010), although these do not as yet take the complex nature of calibrated radiocarbon dates fully into account.

3 The North Wiltshire Downs

Alasdair Whittle, Alex Bayliss and Frances Healy

The North Wiltshire Downs can be defined as the chalk downland bounded by the Vale of Melksham to the north-west and the Vale of Pewsey to the south, including the upper valley of the Kennet in their midst and the Marlborough Downs to the north-east (Fig. 3.1).[1] The area includes three certain causewayed enclosures: the archetypal site of Windmill Hill, on the northern edge of the area, and two much smaller ones, both with well preserved earthworks, at Rybury and Knap Hill on the southern edge, less than 4 km apart and within 8 km of the larger enclosure (Oswald *et al*. 2001, fig. 6.2).

Crofton, Great Bedwyn, to the south-east of these, is often accepted as a further example, but this is questionable on the grounds of both size and location. At over 25 ha, it is more than twice the size of the next largest causewayed enclosure (Oswald *et al*. 2001, fig. 4.23), and more than three times the size of Windmill Hill, the main Hambledon Hill enclosure and Maiden Castle, the largest unambiguous

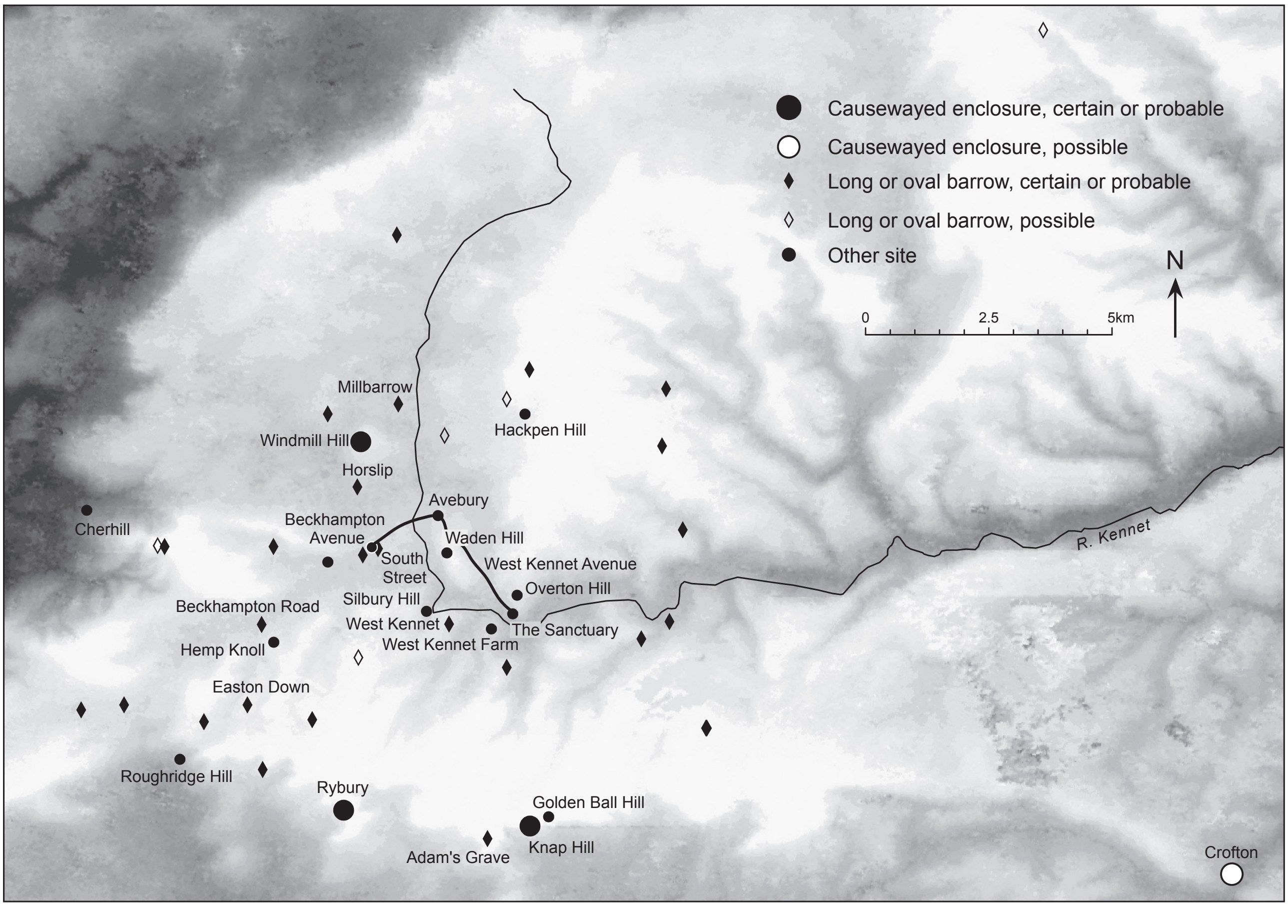


Fig. 3.1. The North Wiltshire Downs showing causewayed enclosures, long barrows and other sites mentioned in Chapter 3.

examples in Wessex. It is even more extensive than the largest enclosures of the third millennium, such as Avebury, Durrington Walls and Marden in Wiltshire, and Mount Pleasant in Dorset (Wainwright and Longworth 1971, fig. 83). Its location, straddling the valley of the river Dunn and encompassing both its slopes, with the circuit possibly open on the downstream side (Oswald *et al*. 2001, figs 4.21, 5.22), invites comparison with those of Durrington Walls and the massive Dorchester timber circle, both built on sloping sites around dry valleys (Wainwright and Longworth 1971, fig. 3; Woodward *et al*. 1993, figs 171–2). Despite its interrupted ditch, the date of this enclosure remains uncertain. The single trench cut across it (Lobb 1995) yielded fresh flint debitage of Neolithic character and a predominantly woodland molluscan fauna, both of which would be compatible with a third millennium cal BC date as well as a fourth millennium one.

Just off the chalk in the west of the area at Cherhill, another site has been mooted as a fourth millennium enclosure by, among others, Joshua Pollard (2005); it has not, however, been included in this project. Here a sinuous, irregular hollow was traced for some 50 m and contained plain Bowl pottery, struck flint, small quantities of animal bone, a fragment of human bone and much sarsen, some of these apparently placed in clusters on the base. Two pits had been dug into the base and deliberately filled, and the subsequent backfilling of the hollow seemed deliberate. A charred *Corylus* timber from the upper part of its initial fills was dated to 3660–3340 cal BC (95% confidence; Table 3.4: BM-493; H. Barker *et al*. 1971, 174; Evans and Smith 1983, 52–8, 111–12, fig. 10). As the excavators pointed out, the depositional practices echo those of causewayed enclosures, and their own interpretation of the feature as simply a linear quarry for marl and fine combe rock which might be used as daub is weakened by the continued dearth of evidence for contemporary timber structures to which it might have been applied. The extreme irregularity of the hollow, however, and the fact that it was seldom more than 0.50 m deep, argue against its having been a monument like the others considered here. It may indicate that different kinds of structures and features were built and used off the Chalk. The relatively low-lying location of Cherhill, on the edge of an historical village and masked by colluvium, means that comparable sites, if they exist, are likely to be under-recognised.

3.1 Windmill Hill, Avebury and Winterbourne Monkton, Marlborough, Wiltshire, SU 08670 71440

Location and topography

The Windmill Hill enclosure lies at 195 m OD, on a down formed by an outlying block of Middle Chalk above surrounds of Lower Chalk (Fig. 3.1). The hill slopes gently south-east towards the Kennet valley and more abruptly to the north-west towards the Lower Chalk and the Vale of Melksham beyond it. The enclosure is centred north-west of the summit of the down and tilts towards the Vale, so that, while it commands views in all directions, these are particularly extensive to the north and west, and the enclosure would itself have been visible from lower-lying ground in that direction (Whittle *et al*. 1999, 7–13; Oswald *et al*. 2001, fig. 5.24: C). The enclosure has a total area of 8.45 ha, making it one of the largest in England (Oswald *et al*. 2001, fig. 4.23). It has three circuits, defined by the inner, middle and outer ditches (Fig. 3.2). The inner ditch, the slightest of the three, has no trace of a surviving bank, and the north-west part of its circuit is concave, probably marking an entrance (I. Smith 1965a, 5; C. Evans 1988a, 139; Oswald *et al*. 2001, fig. 3.16). The middle ditch is nearly circular (Whittle *et al*. 1999, fig. 14), may have traces of a vestigial inner bank, and has a possible entrance, in the form of an exceptionally wide causeway just west of north, slightly offset from the probable entrance in the inner ditch (McOmish 1999, 14, fig. 15: B). The outer ditch is the most substantial of the three and is backed by a largely continuous bank which, in the better preserved north-eastern part of the circuit, survives to 0.70 m high and 5 m wide.

The date of the enclosure and its location in the Avebury area place it near the beginnings of an unique monument complex, whose earliest elements may have been some of the numerous local long barrows (Whittle *et al*. 1999, fig. 7), two of which lie within 1 km of the enclosure: Millbarrow (Whittle 1994) to the north-east, and the Horslip long barrow (Ashbee *et al*. 1979) to the south. Later developments included Silbury Hill (Whittle 1997b; Bayliss *et al*. 2007e), the Avebury henge and avenues (I. Smith 1965a; Gillings *et al*. 2008), the Longstones enclosure (Pollard and Reynolds 2002), and the West Kennet Farm palisade enclosures (Whittle 1997b). In the Early Bronze Age round barrows were built on the hill itself and on the slope to the south (Whittle *et al*. 1999, fig. 9).

History of investigation

Windmill Hill was one of the first causewayed enclosures to be recognised and to be excavated extensively. Its assemblages have played a seminal role in demonstrating the extent of the long- and medium-distance transport of artefacts and materials during the early Neolithic, the character of contemporary animal husbandry, and the development of early and middle Neolithic pottery styles. This section summarises information already presented by Whittle *et al*. (1999, 1–6).

The outer ditch of the enclosure was recognised by Stukeley (1743), as were 15 round barrows on and below the hill, one of which he opened. The enclosure continued to be noted and occasional barrows continued to be opened through the next 150 years. From the early twentieth century, the extensive flint scatter within which the enclosure lies attracted collectors, the most assiduous of whom was the Reverend H.G.O. Kendall, Rector of Winterborne Bassett. Kendall collected from the slopes of the hill (Kendall 1914; 1919; 1922; Holgate 1988a; Whittle

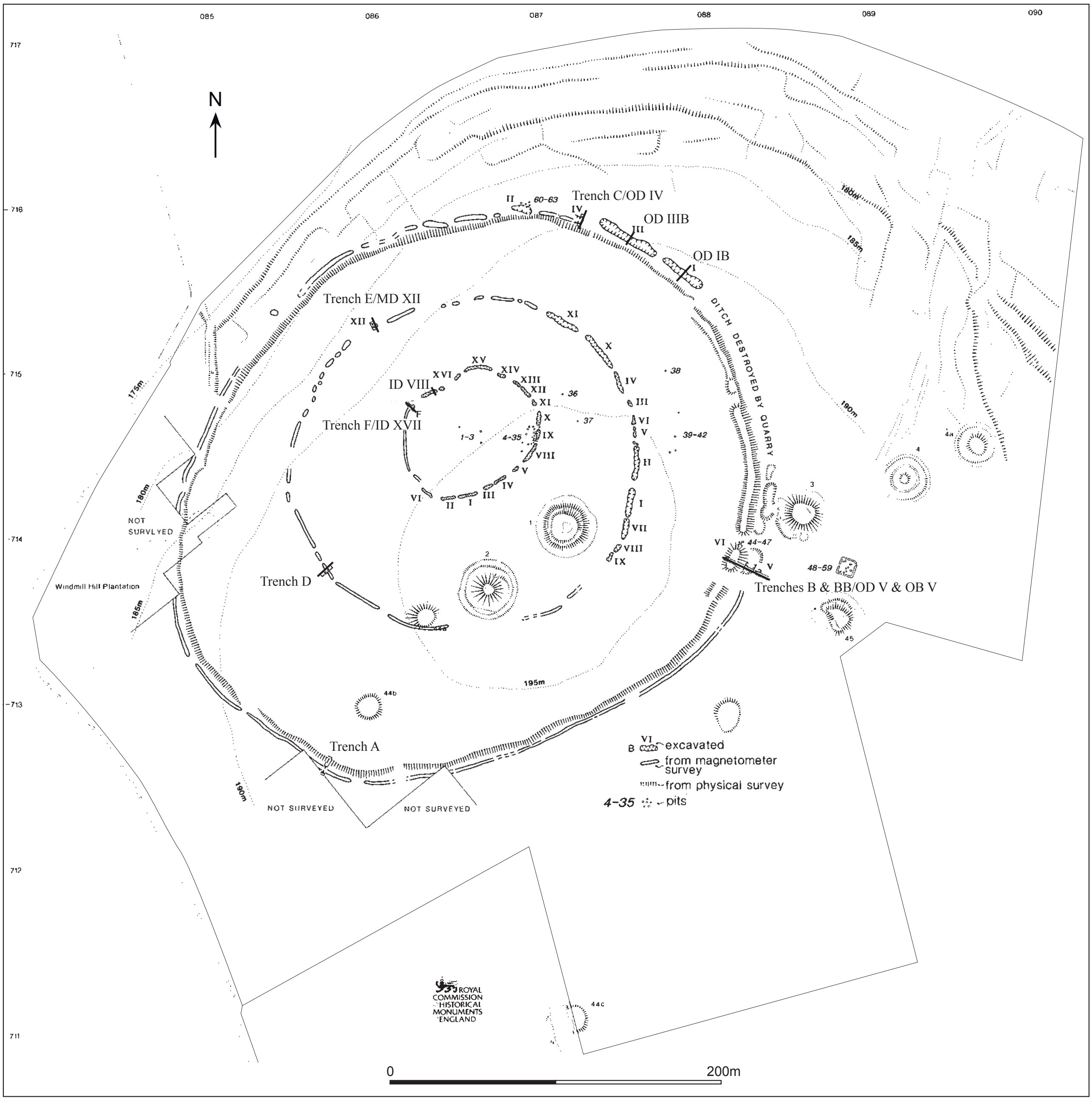


Fig. 3.2. Windmill Hill. Plan, showing the location of cuttings, the results of excavation, earthwork and geophysical survey, and the location of the sections reproduced here. After Whittle et al. *(1999, figs 14–15).*

et al. 2000) and, in 1922–3, he excavated one butt of a segment of the outer ditch (Kendall 1923). The threatened construction of a wireless station on the hill led to its purchase by Alexander Keiller and to his excavations of 1925–9, in the course of which he defined the characteristics of the monument and, for a long time, of the monument class. The scale of Keiller's excavations is noted in Table 3.1; his methods and results are described by Pollard (1999a). Cuttings were numbered consecutively within each ditch in the order in which they were excavated, so that, for example, Inner Ditch VI is next to Inner Ditch II rather than to Inner Ditch V. Most of the excavation was done by workmen and ditch fills were removed in spits, which means that the stratigraphic contexts of finds are not always clear. The locations of significant finds were, however, measured-in, and delicate or 'special' deposits were, once recognised, excavated by professional staff (Fig. 3.3). Articulated burials, both human and animal, and carefully heaped deposits of animal bone were thus exposed and recorded in their entirety. Animal bone, was, however, retained only selectively. It has not, for example, been possible to locate a complete, articulated cattle forelimb photographed in 1928 (Grigson 1999, fig. 165).

By the end of the 1920s, when Keiller's own interest shifted to Avebury, his Windmill Hill excavations had provided the body of evidence which for decades defined the material culture and subsistence base of the early Neolithic population of southern England, most clearly

Table 3.1. Windmill Hill, Wiltshire. Certain and possible pre-Iron Age features.

Element	**Notes**	**Investigation**
Inner Ditch	Ovoid, with indentation in NW. Maximum dimension 85 m, enclosing 0.52 ha. No surviving trace of bank	ID I–XVI (approx. 190 m or 75% of circuit, amounting to approx. 130 m of actual ditch) and E half of interior excavated 1925–9 by Keiller. ID XVII (approx. 1.5 m wide) excavated 1957–8 by I. Smith. Trench F (1 m wide, immediately adjacent to ID XVII) excavated 1988 by Whittle
Middle Ditch	Almost circular. Maximum dimension 220 m, enclosing 3.32 ha. Possible vestigial traces of inner bank	MD I–XI (approx. 185 m or 25% of circuit, amounting to approx. 140 m of actual ditch) excavated 1925–29 by Keiller. MD XII (approx. 1.5 m wide) excavated 1957–8 by I. Smith. Trench E (2 m wide, immediately adjacent to MD XII) excavated 1988 by Whittle. S part of circuit defined by David 1999
Outer Ditch	Ovoid. Maximum dimension 360 m, enclosing 8.45 ha. Substantial remains of inner bank in E, and less pronounced to S. Segments generally longer than those of other ditches	Segment butt adjoining OD I excavated by Kendall 1922–23. OD I–III (approx. 130 m or 9% of circuit) excavated 1925–9 by Keiller. OD IV–VI (8.5 m, OD IV and OD V including the bank, OD VI confined to the bank) excavated 1957–8 by I. Smith. Trenches A, B and C (6 m, C and B immediately adjacent to OD IV and V, A in south of circuit) excavated 1988 by Whittle
Square enclosure	Approx. 9 m x 9 m, lying between two round barrows 43 m E of the gap north of OD VI. Surrounding and in some cases cutting a pit cluster of unknown extent. Date uncertain but presence of oolitic limestone may suggest connection with local long cairns	Ditch, interior and very narrow surrounding margin completely excavated by Keiller
Discrete features	Pits virtually confined to single cluster in stripped E half of interior of inner ditch. Sporadic pits excavated elsewhere in enclosure, probably located by probing. Beaker/EBA pits immediately outside outer circuit, early and late Neolithic pits on slope to south of enclosure. Extent of pit-digging inside and outside enclosure still unknown	Pits in and to N of enclosure excavated by Keiller 1925–9. Pits to S excavated by Whittle 1993
Round barrows	Five within enclosure, more immediately outside it to E and on slope to S	Intermittent antiquarian excavations. Small cutting made by Keiller 1935 in the largest round barrow on the hill (Winterbourne Monkton 2) when a Biconical Urn containing a cremation exposed by rabbit burrowing (I. Smith 1965a, 169–70)
Fourth ditch?	Possibly reflected by the line followed by lynchets around NW, N and NE of the hill, if these do not simple follow the contours. See 3.9	Surveyed by McOmish 1988
Field system	Extending to NW, N and NE of hill	Surveyed by McOmish 1988

Fig. 3.3. Sorting finds on Windmill Hill in the 1920s; the subject is probably Veronica Keiller. Photograph Alexander Keiller Museum, Avebury.

evidenced by the weight accorded the site in Piggott's *Neolithic cultures of the British Isles* (1954). The number of artefacts of non-local stone found on and around the hill (I. Smith 1965a, 110–24; Pollard and Whittle 1999) prompted the foundation of the South-West Group of Museums and Art Galleries' Sub-Committee for the Petrological Identification of Stone Implements, of which Keiller was the first Chair (Piggott 1965, xxi–xxii).

Following Keiller's death in 1955, his widow commissioned Dr Isobel Smith to publish the results of his excavations of both Windmill Hill and Avebury. Smith also undertook small-scale excavations in all three ditches at Windmill Hill in 1957–8 in order to facilitate the interpretation of the earlier excavations. The results of Keiller's and her own investigations (I. Smith 1965a) can be summarised as follows.

There was Neolithic activity on the hill prior to the construction of the inner circuit, which cut some of a cluster of pits, and of the outer circuit, the bank of which overlay artefact scatters, pits and postholes (I. Smith 1965a, 21–8).

Stripping of half the area enclosed by the inner ditch showed that it was virtually devoid of pits outside the single cluster mentioned above. No other areas of the interior were stripped. Pits elsewhere in the enclosure were excavated in individual small trenches (I. Smith 1965a, fig. 3), and were probably identified by probing, a method which Keiller certainly employed (David 1999, 17). Outside the enclosure to the north there were four pits of Beaker or Early Bronze Age date at the outer edge of cutting Outer Ditch II. Others may have extended beyond it.

Further pits and possible postholes were encountered outside the circuits to the east, during the excavation of a square enclosure which may have been a bedding trench for posts. The very few finds from these features would be compatible with a Neolithic date and, since at least one was cut by the enclosure, they may all have predated it. Here again, pits may have extended beyond the excavated area. The date of the square enclosure itself remains uncertain (I. Smith 1965a, 30–3).

Bank structure was preserved only in the outer bank in the east of the circuit. Here, Smith's excavations in cuttings Outer Bank V and VI showed that the first stage of bank construction had been the two low parallel mounds of topsoil and weathered chalk which may have been intended as setting out lines for the bulk of the bank. Her Outer Bank V section shows a contrast between the bank in the area defined by them, which was made up of clearly bedded tips of topsoil and weathered chalk, and the inner edge of the bank beyond their limits, which was built of more jumbled, undifferentiated chalk rubble and earth (Fig. 3.14; I. Smith 1965a, fig. 4).

The fills of all three ditches were asymmetrical, arguing the former presence of internal banks even where none survived. All three were rich in artefacts and food remains, the inner ditch being richest of all; 'there is no doubt whatever

that the mass of this material was deliberately thrown or placed in the hollows' (I. Smith 1965a, 7–8). The absence of any surviving bank inside the inner and middle ditches was attributed to the practice of backfilling material from the bank over deposits placed in the ditch, which at the same time accounted for their integrity and good preservation, with the at least partial survival of the outer bank corresponding to a lower level of cultural material in the fills of the outer ditch (I. Smith 1965a, 15–17; 1966).

The plotting of individual sherds in 1957–8 showed that, in all but one of the sections then excavated, only Neolithic Bowl pottery (Windmill Hill Ware) was present in the primary and secondary fills, with Peterborough Ware, Grooved Ware (Rinyo-Clacton Ware), Beaker, Early Bronze Age and Roman pottery all occurring together in the tertiary fills (I. Smith 1965a, 14–15, figs 5–6). The exception was Outer Ditch V, where six sherds from a pot in the Ebbsfleet substyle of Peterborough Ware were found near the base of the secondary silts, separated by at least 0.65 m of accumulation from the lowest Beaker sherds (I. Smith 1965a, 11–12, fig. 4, fig. 31: P237). This fuelled an argument that the Ebbsfleet substyle developed earlier than the more elaborate varieties of Peterborough Ware (I. Smith 1966a, 474–8).

Analysis of the soil preserved beneath the outer bank and its contained pollen indicated that the soil was truncated and that the vegetation was dominated by weeds of cultivation with some cereals and with hazel outnumbering larger trees; charcoal from the 1957–8 excavations was correspondingly dominated by scrub species, with some oak and ash (Dimbleby 1965). The Mollusca from the same palaeosol, the overlying bank and the adjacent ditch were all, however, woodland species (Maitland Howard 1965). Results from samples taken nearby at a rather later date were comparable (J. Evans 1966; 1972, 242–8; Dimbleby and Evans 1974). A subsequent survey of the evidence has claimed a picture of fragmented, patchy woodland, not the complete woodland cover once suggested (M. Allen 2005; Allen and Davis 2009). Apart from the pollen, evidence for cereal crops was confined to impressions on pottery, which were predominantly of emmer wheat (Helbaek 1952). The animal bone, insofar as it had been retained, was dominated by cattle, many of them over two years old, followed by sheep and goat (Jope 1965).

There was a substantial later Neolithic and Early Bronze Age presence on the hill, seen primarily in the quantities of pottery and lithics of these periods from the tertiary fills of the ditches.

All the struck flint from the hill had been brought there, since neither the Middle Chalk on which the enclosure was built nor the Lower Chalk which surrounds it is flint-bearing (I. Smith 1965a, 85–6). This applies with equal force to the extensive flint scatter on the slopes of the hill to the south of the enclosure (Whittle *et al*. 2000).

In later papers Smith went on to develop the idea of the special nature of the enclosure. This was based on the character of deposition and the practice of deliberate backfilling (I. Smith 1966a, 471–4; 1971, 96–7). Two of her most important contributions were to point out how frequently causewayed enclosures lie across contours, and thus 'face' in certain directions (I. Smith 1971, 92), and how extensively causewayed enclosure ditches were recut. Progressive identifications have shown that the substantial collection of imported stone artefacts from Windmill Hill is part of a larger concentration focussed on the Avebury area, a concentration so great as to be visible on distribution maps compiled at a national scale (Cummins 1979, fig. 1; J. Thomas 1984, 173). Caroline Grigson, who had contributed to the 1965 monograph, continued to work on the Windmill Hill animal bone and published both methodological (Grigson 1982a) and interpretative (Grigson 1984) results. Bob Smith incorporated Windmill Hill into a synthesis of the ecology of Neolithic farming in the area, concluding that the enclosure was marginal to more intensively managed and farmed areas of land down in the Kennet valley (R. Smith 1984). Attention was also turned to the extensive flint scatter on the south slope of Windmill Hill from which Kendall and others had collected. In 1983 fieldwalking by Robin Holgate and Julian Thomas in Gibbs' Field, immediately to the south-west of the enclosure, recovered predominantly later Neolithic material (Holgate 1987; 1988a, 92, fig. 6.13).

Excavation of the enclosure itself resumed in 1988, when Alasdair Whittle cut sections across all three ditches in order to obtain fuller environmental evidence and samples suitable for radiocarbon dating, as part of wider investigations aimed at establishing a more secure local sequence and a fuller sense of environmental variation through time and across the Avebury area (Whittle *et al*. 1999). The exercise was accompanied by earthwork and geophysical survey. A particularly important component was a detailed reassessment of the records and finds from Keiller's excavations. Results included the following.

Earthwork survey showed that a slight trace of a bank, previously unobserved, may survive within the middle ditch and that an apparent double eastern entrance, formed by two breaks in the outer bank some 20 m apart, both corresponding to causeways in the ditch, is not original, since the north gap is crossed by a vestigial bank and the bank terminals on either side of the south one are sharply truncated (McOmish 1999, 14, fig. 15: A). A previously unidentified round barrow was identified to the east of the enclosure.

A magnetometer survey defined the degraded south-west part of the middle ditch for the first time, showing the circuit to have been nearly circular and permitting it to be sectioned in this area in Trench D. The definition of the south and west parts of the outer ditch was enhanced sufficiently to indicate that the segments here were, like those excavated to the north, longer than those of the other circuits. Few internal features were recognised, among them an additional round barrow between the middle and outer ditches, a scattering of possible pits, and a few weakly defined linear anomalies. The poor definition of the southern parts of the middle and outer circuits was shown to be due to cultivation in the historic period (David 1999).

More of the artefact scatter and features beneath Outer Bank V were explored, including the grave of an adult male in which the corpse had lain exposed for some time, on the evidence of displacement of some of the bones and of the presence of the skeletons of numerous frogs and toads and some small rodents, which had apparently fallen into the open grave and been unable to get out.

The outer of Smith's marking out banks was clearly visible, the inner less so. The distinction described above between the clearly bedded forward part of the bank (context 703) and a less differentiated rear part (context 702) was replicated in the 1988 excavation. Pottery from the extenuated tail of the bank (context 701, undoubtedly a product of weathering) was multiperiod, but dominated by sherds of Ebbsfleet Ware (Zienkiewicz 1999, table 155).

Also uncovered were three postholes which aligned with a row already exposed in Outer Bank V and VI (I. Smith 1965a, figs 3, 8) and others running at right-angles to them (Whittle *et al*. 1999, figs 67, 220). The small areas exposed make interpretation difficult. Both excavators suggest that the postholes, and the structure or structures of which they formed a part, may have pre-dated pits sealed by the bank because they were less readily recognised once the bank had been removed (Whittle *et al*. 1999, 78–9). This may, however, reflect the different fills of pits and postholes, and the possibility of timbering connected with the outer bank has to be considered.

Excavation of ditch sections provided the opportunity for detailed study of bone and artefact deposits like those known from photographs and descriptions of the Keiller excavations. The sequence of fills in Trench B, next to Smith's cutting OD V, replicated the sequence recorded by her, including the occurrence of Ebbsfleet Ware near the base of the secondary fills, in this case one sherd only, probably from the same pot as the sherds found by Smith, in bone group 227 on the surface of layer 210 (Whittle *et al*. 1999, fig. 77; Zienkiewicz 1999, 272, table 156, fig. 187: 522). It was only in this cutting that lower and upper secondary fills were distinguished, the latter equating to Smith's layer 2, containing Beaker and Early Bronze Age pottery. The interface of the two was marked by the cutting of small pits or scoops (Whittle *et al.* 1999, 86–7).

The palaeoenvironmental record was greatly enhanced. Soil micromorphology indicated a prolonged human presence, including possible cultivation, before the construction of the outer bank (Macphail 1999). Molluscan analysis confirmed disturbance to the soil prior to the construction of the outer bank and emphasised that the surrounding area before and during the construction and early use of the enclosure was predominantly wooded, more so than that of local long barrows. In the outer ditch, woodland species were predominant throughout the primary and lower secondary fills, but with a temporary drop in overall numbers and an increase in species diversity at the junction of the chalk rubble fills with the overlying silts. Open conditions were reflected only from the upper secondary fills onwards (Fishpool 1999). Attempts to extract countable quantities of pollen from samples from beneath the outer bank and analysis of a comparative sequence from the surface of the bank resulted in the conclusion that there had probably been differential post-depositional destruction of tree pollen (M. Walker 1999).

A major achievement of the 1999 publication was the contextualisation of a high proportion of the finds from the Keiller excavations. Reconstruction, as far as was possible, of the deposits in each segment (J. Pollard 1999a) made it possible to identify significant differences between the depositional signatures of the three ditches (Grigson 1999, fig. 185; Zienkiewicz 1999, figs 193–6; Whittle *et al*. 1999, 357–71).

In 1992–3 the lithic scatter on the south slope of the hill was investigated by geophysical survey, fieldwalking, test-pitting and excavation (Whittle *et al*. 2000). The exercise focussed on North Field, immediately east of the areas walked by Holgate and Thomas, although geophysical survey extended on to it (Whittle *et al*. 2000, fig. 1). Both fieldwalking and test-pitting returned highest densities in the north of the field, close to the enclosure, and continuation of one row of test-pits downslope showed that falling densities were genuine, and not simply an effect of colluviation. Bronze Age material tended to concentrate around the known round barrows. Investigation of 18 magnetic anomalies led to the discovery of Neolithic pits in only two. A cluster of intercutting early Neolithic pits 100 m south-east of the enclosure contained moderate quantities of artefacts and animal bone, and far more abundant charred cereals and wild plant foods, especially hazelnut shells, than those thinly scattered through the enclosure ditch fills (Fairbairn 1999a; 2000). Perhaps correspondingly, the pits in this group yielded a quern fragment and two rubbers. Two more widely spaced late Neolithic pits 200 m south of the enclosure yielded lower levels of cereal and higher levels of hazelnut shell along with far more abundant charcoal than in the earlier pits.

Previous dating

In presenting the results of the excavations of both Keiller and herself, Isobel Smith had three radiocarbon dates at her disposal (Table 3.2: BM-73–5), but her principal reference in discussing sequence and chronology was the combination of stratigraphy and finds. The radiocarbon dates, two from the ditches and one from the buried soil under the Outer Bank, were duly noted and their contexts compared (I. Smith 1965a, 11, 28); unidentified charcoal was used and the material for BM-74 was bulked from segments of the middle and outer ditches (see below). In her introduction, Smith used the uncalibrated radiocarbon determinations to suggest a date of '*c*. 3000 B.C.' (i.e. *c*. 3790–*c*. 3650 cal BC) for earlier settlement on the hill, and a date 'round the middle of the third millennium B.C.' (i.e. *c*. 3350–*c*. 3000 cal BC) for the construction of the enclosure, by then 'the type-site for the earlier Neolithic culture of southern England' (I. Smith 1965a, xxvii). Sherds said to be from the same vessel were recognised in all three circuits, and in other instances from two of the three circuits, and this

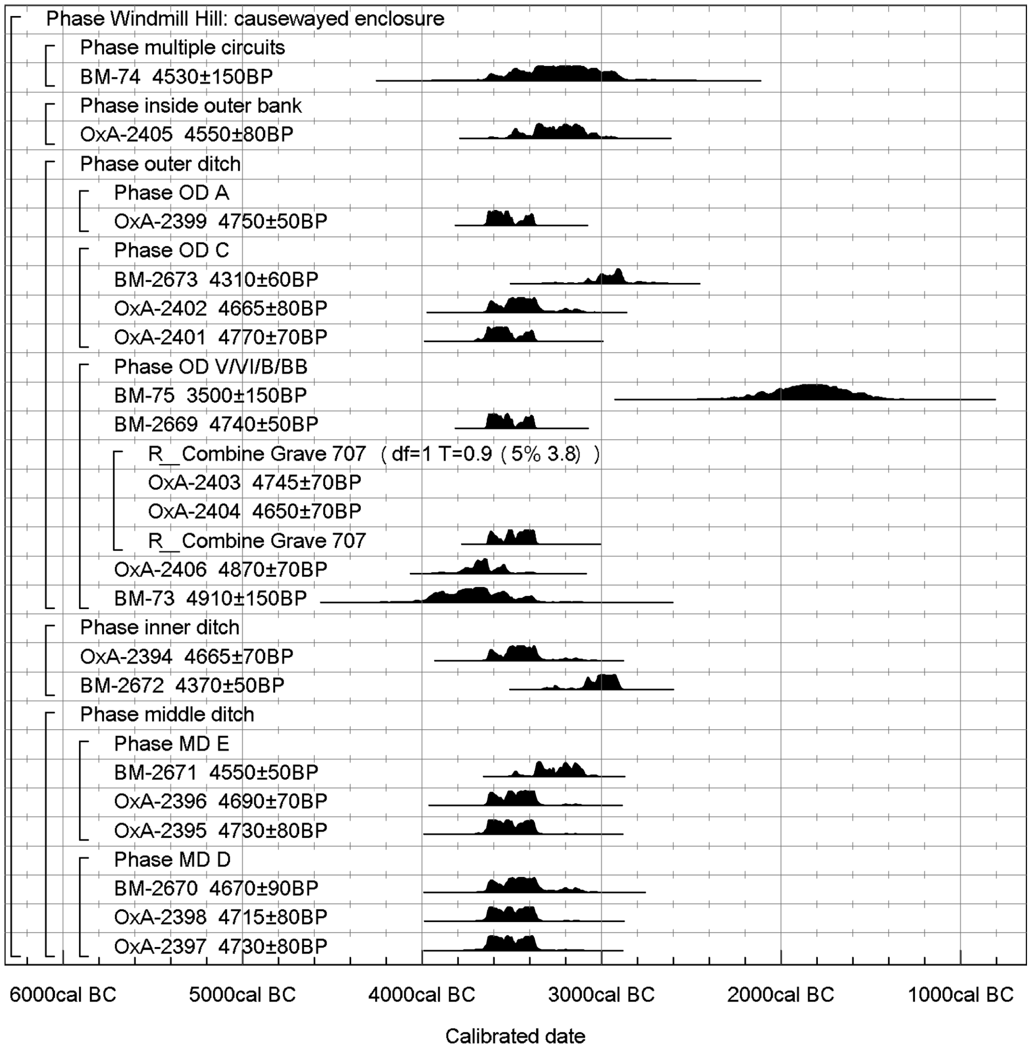


Fig. 3.4. Windmill Hill. Probability distributions of calibrated radiocarbon dates obtained before 1999.

evidence was taken to indicate that all three ditches had been open at the same time (I. Smith 1965a, 14). Slower secondary silting was contrasted with more rapid primary filling of the ditches, and deliberate backfilling of the banks was recognised as another factor (I. Smith 1965a, 11, 17; 1966). Further discussion of the nature of the causewayed enclosure, here and in later papers (I. Smith 1966; 1971) was largely without reference to dating.

The 17 dates obtained from samples excavated in 1988 were taken by Ambers and Housley (1999, 118) to form a very coherent group, without significant problems of disturbance or residuality (Fig. 3.4). They were used to suggest at least three, and perhaps four, broad chronological phases: first, pre-enclosure activity sometime in the first half of the fourth millennium cal BC; second, the construction of the enclosure in the middle of the fourth millennium cal BC, together with the digging of a burial into the old land surface; third, some activity represented under the tail of the outer bank and at the junction of the primary and secondary fills of the middle ditch, dating to the latter half of the fourth millennium cal BC; and fourth, continued deposition in secondary ditch contexts at the end of the fourth millennium or the beginning of the third millennium cal BC (Ambers and Housley 1999, 119–20).

In further discussing these results, Whittle *et al*. (1999, 352–3, 367–9) concentrated on timespans for both the whole construction and individual segments, rather than on the local absolute dating sequence already proposed (Whittle 1993), in which pre-enclosure activity on Windmill Hill was tentatively thought to begin in Phase B (5150–4850 BP or *c*. 4000–*c*. 3500 cal BC) and to continue into Phase C (4850–4550 BP or *c*. 3700–*c*. 3100 cal BC), during which the enclosure was built. It was suggested that the primary use of the enclosure lasted at least 200 hundred years, and the possibility of a succession of circuits was mooted, 'which the radiocarbon method is not precise enough to distinguish' (Whittle *et al*. 1999, 352). Varied histories and rates of deposition were envisaged for both the individual circuits and individual ditch segments within each circuit, through the long primary use of the enclosure (Whittle *et al*. 1999, 368). Molluscan evidence was used to suggest the possibility that the outer circuit might have been added later than the middle and inner ditches (Whittle *et al*. 1999, 353).

Table 3.2. Radiocarbon dates from Windmill Hill, Wiltshire. Posterior density estimates derive from the model defined in Figs 3.8–11.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**$\delta^{15}N$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
BM-74	Sample B	Bulk sample of unidentified charcoal	Layers 4 and 5 in Outer Ditch V and equivalent layers in Middle Ditch XII	4530±150				3650–2850	
Inner Ditch									
OxA-13760	Charcoal ID VII bottom	Single fragment of *Corylus avellana* charcoal	Inner Ditch VII, ditch bottom. From a sample of comminuted chalk with charcoal collected from bottom of ditch, beneath spit 5. The segment is described by J. Pollard (1999a, 53–6). From same find as GrA-25379	4891±31	−26.1			3710–3640	*3680–3635*
GrA-25379	Charcoal ID VII bottom	Single fragment of *Corylus avellana* charcoal	From same find as OxA-13760	4910±50	−24.5			3790–3630	*3685–3630*
OxA-13815	WH26 B25	Red deer antler beam with trez tine	Inner Ditch VII, spit 5, at 4.5 ft (1.37 m). The relevant entry in the Keiller catalogue is annotated 'in chalk rubble at foot of ditch'. Spit 5 (4 ft to base) was the lowest and the antler at this depth would have been close to the base (J. Pollard 1999a, 53–6, figs 50–52). Stratified above GrA-25379 and OxA-13760, from same spit as 'fine deerhorn pick' (B24; not found 2003–5), GrA-29746, GrA-29708	4798±34	−22.6			3650–3520	*3645–3620* (*18%*) or *3610–3520* (*77%*)
GrA-29708	WH26 B23	Red deer antler tine with worn, battered tip, charred towards junction with beam	From the same spit as OxA-13815	4700±35	−22.9			3640–3360	*3635–3555* (*40%*) or *3540–3480* (*36%*) or *3475–3410* (*19%*)
OxA-14975	WH26 charcoal ID VII spit 5 /A	Single fragment of *Corylus avellana*	From the same spit as OxA-13815 and same sample as GrA-29746, extracted from sample of chalk with charcoal fragments	4703±36	−24.5			3640–3360	*3635–3555* (*43%*) or *3540–3480* (*35%*) or *3475–3410* (*17%*)
GrA-29746	WH26 charcoal ID VII spit 5 /B	Single fragment of *Corylus avellana*	From the same spit as OxA-13815 and same sample as OxA-14975	46852±40	−25.2			3630–3360	*3635–3555* (*32%*) or *3540–3415* (*63%*)
OxA-13732	WH26 sherd 2896	One of several large, well preserved joining Neolithic Bowl sherds with internal residue. Replicate of GrA-25391	Inner Ditch VII, spit 4 (0.70–1.00 m; joining sherds recorded at depths between 2.3 and 3 ft (0.30–0.90 m). Spit 4 was the penultimate one, and probably included parts of the primary and secondary fills (J. Pollard 1999a, 53–6). 1 sherd Beaker and 2 sherds EBA present in spit, as well as much Bowl	4672±45	−12.8	6.6	4536±33 T'= 21.4, $T'(5\%)$=3.8, ν=1	3630-3350	*3510–3360*

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**$\delta^{15}N$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
GrA-25391	WH26 sherd 2896	Replicate of OxA-13732	From same spit as OxA-13732	4360±50	−28.3				
GrA-25558	WH26 B22.a	Dog mandible, found with skull fragments	Inner Ditch VII, spit 4 (0.70–1.00 m). From same spit as OxA-13732, found with sheep/goat longbones B22.b, 22.c.	4690±40	−20.9	9.4		3640–3360	*3515–3485 (9%)* or *3475–3365 (86%)*
OxA-13715	WH26 B22.c	Sheep/goat. L humerus, articulating with radius (WH26 B22.b)	From same spit as OxA-13732, found with dog skull B22.a.	4710±29	−21.0	5.2		3640–3370	*3520–3495 (8%)* or *3465–3370 (87%)*
OxA-14968	WH29 B759	Pig. One of two fitting R metatarsals	Inner ditch XII, spit 2b. Spit 2 was 1–2 ft below the surface and was the middle spit of three in a shallow segment. There is no record of the fills, although there were five distinct and substantial bone groups in spits 2 and 3 (I. Smith 1965a pl. Va; J. Pollard 1999a, 61– 3, figs 49, 53, 59–60). The pottery from spit 2 was mainly Bowl, with one sherd of Peterborough Ware (Zienkiewicz and Hamilton 1999, table 166)	4747±33	−20			3640–3370	*3640–3500 (79%)* or *3430–3380 (16%)*
GrA-29707	WH29 B322	Cattle. Complete R femur, articulating with R tibia (B340), also complete and in identical condition	Inner ditch XVI, spit 3a. Spit 3 lay at 2–3 ft and was the antepenultimate one (J. Pollard 1999a, 53–6, figs 49, 53, 54). The pottery from the spit was mainly Bowl with 5 sherds of Peterborough Ware and four of indeterminate ?Late Neolithic/early Bronze Age (Zienkiewicz and Hamilton 1999, table 166). Close to the SW butt, a cattle pelvis, femur, tibia and astragalus, all complete, lay close together in this layer (J. Pollard 1999a, 56; I. Smith 1965a, pl. Vb). The present sample almost certainly equates to the femur from this group	4725±35	−22.0			3640–3370	*3635–3550 (40%)* or *3540–3495 (21%)* or *3460–3375 (34%)*
OxA-2394	WH88 6464	Cattle. Sixth cervical vertebra	Inner Ditch XVII, Trench F. The only bone in silt lens 613, within primary chalk rubble 612, closes to base of ditch. Stratified below contexts 629 and 630 (Whittle *et al.* 1999, fig. 95)	4665±70	−22.1			3640–3130	*3635–3555 (19%)* or *3540–3355 (76%)*
GrA-25560	WH88 6419 (B1344)	Cattle. R proximal metatarsal fragment found in articulation with R navicular and posterior cuneiform (WH88 6420/ B1342, B1343; Whittle *et al.* 1999, fig. 97: 9, 26)	Inner Ditch XVII, Trench F, bone heap 630 on surface of context 610 (the topmost layer of primary chalk rubble fill). Stratified above context 613, in uncertain relation to context 629 (Whittle *et al.* 1999, figs 95–6)	4500±40	−22.1	5.4		3360–3020	*3485–3470 (3%)* or *3370–3315 (92%)*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
BM-2672	WH88 6389	Cattle. Vertebra	Inner Ditch XVII, Trench F, bone deposit 629 in base of layer 604 at the bottom of the secondary silts. Stratified above context 613, in uncertain relation to context 630 (Whittle *et al.* 1999, figs 95–6)	4370±50	−21.4			3260–2880	
Middle Ditch									
BM-2670	WH88 4374	Cattle. Tibia	Middle Ditch, Trench D, bone deposit 418 within layer 416, between a cattle skull, which overlay it, and the ditch base (Whittle *et al.* 1999, fig. 86)	4670±90	−22.8			3650–3100	*3655–3475*
UB-6186	WH88 4360 (B1425)	Red deer antler base with brow tine, pick	From same context as BM-2670	4699±20	−21.2± 0.5		4708±13 T′=5.2; T′(5%)=9.5; ν=4	3630–3375	*3630–3585* (*83%*) or *3525–3500* (*12%*)
OxA-15075	WH88 4360 (B1425)/A	Replicate of UB-6186, OxA-15076, -1508, GrA-29706	From same context as BM-2670	4717±30	−20.6				
OxA-15076	WH88 4360 (B1425)/A	Replicate of UB-6186, Ox-15075, -15088, GrA-29706	From same context as BM-2670	4673±30	−20.8				
OxA-15088	WH88 4360 (B1425)/A	Replicate of UB-6186, OxA-15075, -15076, GrA-29706	From same context as BM-2670	4770±33	−20.7				
GrA-29706	WH88 4360 (B1425)	Replicate of UB-6186, OxA-15075, -15076, 15088	From same context as BM-2670	4700±40	−21.3				
OxA-13814	WH88 4328 (B1742)	Cattle. R radius articulating with ulna (WH88 4329/B1761). Mistakenly entered as such on submission form. Replicate of OxA-14967	Middle Ditch, Trench D, context 416 (Whittle *et al.* 1999, fig. 86). Overlying initial silt 417 in angle of ditch base and wall, overlying ditch bottom elsewhere, incorporating bone deposit 418. Stratified below context 414	4807±32	−21.9		4769±23 T′= 2.9; T′(5%)= 3.8; ν =1	3640–3510	*3640–3525*
OxA-14967	WH88 4329 (B1761)	Cattle, R ulna articulating with radius WH88 4328 (B1742). Replicate of OxA-13814	From the same context as OxA-13814	4729±33	−21.4				
GrA-25706	WH88 4330 (B1743)	Cattle, R radius, articulating with R ulna (WH88 4331/B1733)	From same context as OxA-13814	4740±45	−22.5	4.8		3650–3370	*3640–3515*

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**$\delta^{15}N$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
OxA-2397	WH88 4232	Cattle. Scapula	Middle Ditch, Trench D, bone deposit 414 in layer 411 (Whittle *et al.* 1999, figs 86–7). Stratified above context 416 and below context 413	4730±80	−22.5			3660–3350	*3590–3390*
OxA-13714	WH88 4255 (B1458)	Medium mammal. Rib section, from different L rib to GrA-25556	From same context as OxA-2397. One of several interleaved rib fragments composed of WH88 4241 (B1442), 4225 (B1441), 4234 (B1459–64), 4235 (B1446), 4236 (B1456–7), 4241 (B1442), 4242 (B1449), 4243 (B1447), 4244 (B1444), 4245 (B1445), 4247 (B1448), 4238 (B1435), 4251 (B1452), 4255 (B1458), 4256 (B1454–5) (Whittle *et al.* 1999, figs 86–7)	4746±32	−22.0	6.4		3640–3375	*3605–3495* (*72%*) or *3455–3380* (*23%*)
GrA-25556	WH88 4225 (B1441)	Medium mammal rib section, from different L rib to sample for OxA-13714	From same context as OxA-2397, -13714	4735±40	−23.2	6.1		3640–3370	*3600–3490* (*65%*) or *3470–3385* (*30%*)
OxA-2398	WH88 4179	Cattle (?aurochs). Calcaneum	Middle Ditch, Trench D, bone deposit 413 in layer 411 (Whittle *et al.* 1999, figs 86, 88). Stratified above context 414	4715±80	−22.6			3660–3340	*3520–3350*
OxA-13813	WH88 4194 (B1600)	Cattle. Part of one of 4 fragmentary dorsal vertebrae (the others are find 4188 (B1593–8))	From same context as OxA-2398 (Whittle *et al.* 1999, fig 88: 11, 12)	4682±34	−21.8			3630–3360	*3520–3485* (*9%*) or *3475–3365* (*86%*)
OxA-13680	WH25 B6	Red deer. Antler crown, ?pecked from beam	Middle Ditch I (N part of segment, excavated 1925 by Gray). Catalogue entry annotated 'at 4 (Ex no 34'). This places it 4 ft deep, near the junction of the primary chalk rubble and the secondary fills (J. Pollard 1999a, fig. 42, bottom left) It is difficult to relate the context of this sample to those of samples from the rest of the segment (Middle Ditch IB), excavated by Keiller in 1928	4403±33	−21.0	5.2		3260–2910	
GrA-25554	WH28 B114	Red deer antler beam with trez tine, cut below tine, very smooth	Middle Ditch IB, spit 5A (4–5 ft (1.20 m–1.50 m)). This was the lowest spit and would have been within the primary fills (J. Pollard 1999a, 47–51, fig. 41). At a lower level than spit 4	4725±40	−21.8	4.6		3640–3370	*3640–3585*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-25559	WH28 B374	Cattle. R magnum, articulating with R scaphoid (also B374)	Middle Ditch IB, spit 4 (3–4 ft (0.90 –1.20 m)). This was the penultimate spit and would probably have been mainly in the upper part of the primary fill (J. Pollard 1999a, 47–50, fig. 42 bottom left). At a higher level than spit 5 and a lower level than spit 3. Sample may have come from same deposit as R cattle carpals from spit 3 in same segment, which immediately overlay spit 4	4730±40	−22.9	5.3		3640–3370	*3630–3540*
GrA-25555	WH28 B369	Cattle. R magnum from complete set of 5 R carpals, articulating	From same spit as GrA-25559. Sample may have come from same deposit as R cattle carpals from spit 3 in same segment, which immediately overlay spit 4. At a higher level than spit 5 and a lower level than spit 3	4685±40	−23.8	5.0		3640–3360	*3630–3545*
OxA-13812	Toad MD IB L4 at 3ft 6 in	Vertebrae and long bones from one toad (extracted from larger collection from all parts of body — no duplicates present)	From same spit as GrA-25559. At this depth, the toad would probably have been near the top of the primary fills, an unlikely depth for a hibernation death	4826±33	−20.8			3660–3530	*3605–3535*
OxA-13679	WH28 B372	Cattle. R scaphoid, articulating with R magnum (also B372)	Middle Ditch IB, spit 3 (0.60–0.90 m). This was the antepenultimate spit and would probably have been mainly in the secondary fills (J. Pollard 1999a, 47–50, fig. 42 bottom left). At a higher level than spit 4	4839±32	−22.0	5.5		3690–3530	*3580–3520*
OxA-13505	WH28 B106	Dog. 4 articulating R metacarpals from a substantial part of an articulated skeleton, if not a complete one. There are, for example, numerous articulating vertebrae	From same spit as OxA-13679	4649±30	−20.4	7.3		3520–3350	*3520–3395* (*81%*) or *3385–3360* (*14%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-15177	WH27 1924	Cattle. L humerus articulating with scapula from partial cattle skeleton (Murray 1999, fig. 44)	Middle ditch, IVB, spits 4 (2.3–3.5 ft) and 5 (3.5 ft – base). Mentioned in letter from Keiller to Childe 6/3/28: 'a skeleton, which has taken nearly eight months to reconstruct, of an almost complete ox including head, on the forehead of which are curious markings, apparently artificial, from the bottom two layers of cutting IV of the Middle Ditch of Windmill Hill' . No further surviving record (J. Pollard 1999a, 42). 'Curious markings' on forehead are faint horizontal line crossed by several parallel oblique lines. The occurrence of the skeleton in two successive spits means that it extended from the lower spit into the upper	4686±33	−21.6			3630–3360	*3630–3590* (*10%*) or *3530–3365* (*85%*)
GrA-25368	WH88 12371a	Toad. Bones of hind limbs from almost complete skeleton (Rouse and Rowland 1999, table 154). From same skeleton as sample for OxA-13730	Middle Ditch XII, Trench E, low-density bone spread 527 within context 515 just above base of ditch, approx. 1.25 m from the modern surface. Stratified below contexts 525, 523, 510 (Whittle *et al.* 1999, 100, figs 89–90)	3650±50	−21.1	3.1	3558±26 (2010–1770 cal BC) T′=4.7; T′(5%) =3.8); ν=1	1970–1770	
OxA-13730	WH88 12371b	Toad. Bones of fore limbs from almost complete skeleton (Rouse and Rowland 1999, table 154). From same skeleton as sample for GrA-25368	From same context as GrA-25368	3524±30	−20.0	7.6			
OxA-2395	WH88 12361	Pig. Humerus	From same context as GrA-25368	4730±80	−21.6			3660–3350	*3655–3430*
OxA-2396	WH88 12369	Pig. Scapula	From same context as GrA-25368	4690±70	−21.3			3650–3340	*3640–3430*
OxA-13713	WH88 12301 (B54)	Cattle. Lunate from same forelimb as anterior cuneiform, hamatum (both 12291/B43, B44), and pisiform (12310/B55)	Middle Ditch XII, trench E, lower part of bone deposit 525 in lower part of context 508 at top of primary fills (Whittle *et al.* 1999, 99–101, figs 89, 93). Hamatum and cuneiform close together, in same find. Lunate *c.* 0.10 m away. Stratified above context 527, stratigraphically equivalent to contexts 523, 510	4695±38	−22.1	5.3		3640–3360	*3530–3365*

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**$\delta^{15}N$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
GrA-25707	WH88 12281 (B70)	Cattle. 6th lumbar vertebra found together with 5th lumbar vertebra and sacrum from same animal	From same context as OxA-13713	4675±40	−23.1	5.3		3630–3360	*3520–3365*
BM-2671	WH88 12278	Cattle. Humerus	Middle Ditch XII, trench E, bone deposit 523 in top of 510. Stratified above context 527, stratigraphically equivalent to contexts 525, 510 (Whittle *et al.* 1999, figs 89, 91)	4550±50	−21.2			3500–3090	*3495–3465* (*4%*) or *3385–3315* (*91%*)
Outer Ditch									
OxA-2399	WH88 1710	Human. Cranium of 3–4 year-old child	Outer Ditch, Trench A, bone deposit 117, in the top of layer 112. Cranium lying between a cattle frontlet and a cattle scapula and tibia fragment, approx. 1 m above ditch base (Whittle *et al.* 1999, fig. 81, fig. 82: 4). Stratified beneath context 115	4750±70	−22.3			3660–3360	*3655–3485*
OxA-13503	WH88 1712 (B18)	Cattle. Proximal metatarsal fragment (B18), articulating with complete navicular (B19) and complete cuneiform (B20)	From same context as OxA-2399, lying *c.* 0.35 m from a cattle frontlet, approx. 1 m above ditch base (Whittle *et al.* 1999, fig. 81, fig. 82: 8)	4825±32	−22.2	4.8		3660–3530	*3655–3625* (*39%*) or *3600–3525* (*56%*)
GrA-25546	WH88 1687 (B5338)	Large mammal. Part of 1 of 3 interleaved proximal rib fragments (WH88 1688 (B5330), 1686 (B5337), 1687 (B5338))	Outer Ditch, Trench A, bone group 115 in top of layer 111 (Whittle *et al.* 1999, 90). Stratified above context 117	4765±40	−22.2	4.1		3650–3370	*3605–3495* (*60%*) or *3455–3375* (*35%*)
OxA-13504	WH88 1688 (B5330)	Large mammal. Part of 1 of 3 interleaved proximal rib fragments	From same rib bundle and same context as GrA-25546	4620±31	−21.3	4.7		3510–3350	*3515–3425* (*67%*) or *3385–3345* (*28%*)
OxA-13501	WH28 B671	Cattle, 1 of several caudal vertebrae, with unfused epiphyses	Outer Ditch IB, spit 7 (6–7 ft (1.80–2.10 m). This was the penultimate spit and would have been within the primary fills (J. Pollard 1999a, fig. 26: top left)	4860±31	−21.3	4.7		3710–3540	*3665–3625* (*58%*) or *3585–3530* (*37%*)
GrA-25545	WH28 B370	Cattle. R magnum articulating with hamatum (both B370) and with metacarpal B441 from spit 6	From same spit as OxA-13501	4780±40	−22.8	4.2		3650–3380	*3645–3510* (*89%*) or *3425–3380* (*6%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-13502	WH28 B145a	Red deer. One of two proximal phalanges (lateral and medial), likely to have been side-by-side in the same foot because comparable in size and muscle attachments	Outer Ditch IB, spit 3 (2–3 ft (0.60–0.90 m). The spit would probably have been within the primary fills at the inner edge of the ditch and within the secondary and tertiary fills at the outer (J. Pollard 1999a, fig. 26: top left)	4164±35	−22.2	5.1		2890–2580	
OxA-14966	WH29 B209 a	Human. Sample from L ilium of articulated skeleton of child of 2–3 years (I. Smith 1965a, pl. VIIIa). Replicate of GrA-29711	Outer ditch IIIB, spit 5 (4–5 ft). IIIB was the central part of the segment, which encompassed two subsegments and a higher ridge between them. The skeleton lay on the base of the ditch in its shallowest part, against the inner side (I. Smith 1965a, 9; J. Pollard 1999a, 30–4)	4521±35	−21.1	11.9	4562±26 T′=3.1; T′(5%)= 3.8; ν =1	3370–3120	*3490–3470* (*9%*) or *3370–3330* (*86%*)
GrA-29711	WH29 B209 b	Replicate of OxA-14966	From same spit as OxA-14966	4615±40	−21.7				
OxA-2401	WH88 10457	Cattle. Astragalus.	Outer Ditch IV, Trench C, bone deposit 321 within layer 320. Compact group almost entirely of cattle bones, many of them conjoining or articulating. In secondary silts silt overlying primary rubble and silt fills (Whittle *et al.* 1999, figs 83, 84). Stratified below context 317	4770±70	−22.3			3700–3360	*3650–3490* (*71%*) or *3470–3370* (*24%*)
GrA-29712	WH88 10455 (B74)	Cattle. L metatarsal shaft with fitting unfused epiphyses (10454), articulating with navicular (10464), which articulates with posterior cuneiform (10477) (Whittle *et al.* 1999, 12, 18, 19)	From same context as OxA-2401	4715±35	−23.2			3640–3370	*3635–3555* (*31%*) or *3540–3490* (*21%*) or *3470–3370* (*43%*)
GrA-29713	WH88 10458 (B248)	Cattle, 1 of 3 articulating dorsal vertebrae, 2 with fitting unfused epiphyses (Whittle *et al.* 1999, fig. 84: 7)	From same context as OxA-2401	4675±40	−22.7			3630–3360	*3630–3585* (*9%*) or *3530–3360* (*86%*)
OxA-2402	WH88 10452	Cattle. Humerus	From same context as OxA-2401	4665±80	−23.8			3650–3100	*3635–3550* (*20%*) or *3540–3350* (*75%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
BM-2673	WH88 3915	Cattle. Scapula	Outer Ditch IV, Trench C, bone deposit 317 at base of incipient soil 316 formed over secondary fills. 1 Beaker sherd present (Whittle *et al.* 1999, figs 83, 85; (Zienkiewicz 1999, table 158). Stratified above context 321	4310±80	−23.0			3090–2780	
GrA-29714	WH88 10414	Single fragment of *Corylus* charcoal	Outer Ditch IV, Trench C, context 305? This was a compact grey chalky silt with scattered chalk, derived from the interior (Whittle *et al.* 1999, fig. 83). Stratified below context 321 The find is recorded as from 308, but good agreement with OxA-14965 and the fact that this date is later than those of overlying articulated samples in bone deposit 321 suggests that there may have been an error in transcribing the final digit of the context and that the sample may in fact have come from 305	4120±35	−24.9			2880–2570	
OxA-14965	WH88 10343	Single fragment of *Corylus* charcoal	Outer Ditch IV, Trench C, context 305. This was a compact grey chalky silt with scattered chalk, derived from the interior (Whittle *et al.* 1999, fig. 83). Submitted in the belief that it came from 308. The notebook for Trench C, however, places the find in 305	4089±34	−24.4			2860–2490	
BM-73	Sample A	Bulk sample of unidentified charcoal	Outer Bank V, old land surface under (I. Smith 1965a, 28). Denis Grant King's original section drawing (Alexander Keiller Museum 78510392) shows location of 'sample charcoal' under W, clearly-bedded, part of bank in S face of cutting	4910±150				3990–3360	*3995–3635*
OxA-2406	WH88 7839	Cattle. Vertebra	Outer Bank V, Trench BB, surface of soil (747) under 'setting out bank' (750), (Whittle *et al.* 1999, figs 69–71).	4870±70	−25.5			3790–3520	*3895–3875* (*1%*) or *3800–3630* (*94%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-2403	WH88 7595/90	Human. Rib of adult male	Outer Bank V, Trench BB, from articulated skeleton lying on minimal amount of chalk silt on base of grave cut through pre-bank soil. Some parts of the skeleton were displaced. This, numerous amphibian bones, and some rodent bones suggest that the grave was left open before backfilling. The near-vertical sides of feature, which show possible slight weathering-back only at the very top, suggest that this was not for long. Stratified below sample for OxA-2404 (Whittle *et al.* 1999, figs 70, 73, 76). Sections published by both Whittle *et al.* (1999, fig. 70) and Smith (1965a, fig. 4) both suggest that the grave was grave at the tail of the clearly-bedded W part of the bank, not necessarily covered by it	4745±70	−22.5			3660–3360	*3650–3480* (*64%*) or *3475–3370* (*31%*)
OxA-2404	WH88 7393	Pig. Scapula	Outer Bank V, Trench BB, layer 733, topmost fill of grave 707, in base of which was sample for OxA-2403. It is unclear whether 733 was backfill or soil accumulated in a hollow formed by the subsiding fill. Overlain by chalk rubble of bank. Stratified above sample for OxA-2403 (Whittle *et al.* 1999, fig. 73)	4650±70	−21.9			3650–3100	*3635–3560* (*15%*) or *3540–3345* (*80%*)
OxA-2405	WH88 7284	Cattle. Humerus	Outer Bank V, Trench BB, on surface of soil 705 sealed by tail of outer bank, beyond limits of possible original bank (Whittle *et al.* 1999, figs 69–71)	4550±80	−23.5			3550–2900	*3625–3600* (*2%*) or *3525–3320* (*93%*)
OxA-13499	WH57–58 85	Plain shell-tempered Neolithic Bowl body sherd with internal residue under chalky deposit. In fresh condition, including the ancient breaks, which are covered by the same skin of chalky deposit as the faces. No sign of weathering	Outer Ditch V, bottom of ditch, beside sample for GrA-25549. Stratigraphically earlier than context 229	4728±32	−27.6	6.1		3640–3370	*3640–3495*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-25549	WH57–58 86	Plain shell-tempered Neolithic Bowl body sherd with internal residue under chalky deposit. In fresh condition, including the ancient breaks, which are covered by the same skin of chalky deposit as the faces. No sign of weathering	From same context as OxA-13499 and beside it	4740±40	−27.6			3640–3370	*3640–3500*
BM-2669	WH88 23200	Cattle. Tibia shaft	Outer Ditch V, Trench B, bone deposit 229, between layers 228 and 210, within a few cm of ditch base (Whittle *et al.* 1999, fig. 78: 6). Stratified above samples on ditch base and below context 210	4740±50	−21.9			3650–3370	*3600–3490* (*44%*) or *3470–3370* (*51%*)
OxA-13561	WH88 23250a	Part of a substantial portion of a plain bowl with external and internal residue (Whittle *et al.* 1999, fig. 187: 516). Replicate of GrA-25389	From same context as BM-2669	2770±40	−28.3	3.2	3344±31 (1740–1520 cal BC) T′=391.2; T′ (5%)=6; ν=2	1010–820	
GrA-25389	WH88 23250b	Replicate of OxA-13561; alkali fraction from same sample as residue measured by *GrA*-25821	From same context as BM-2669	4050±150	−29.1			2950–2100	
GrA-25821	WH88 23250b	Replicate of OxA-13561; residue from same sample as alkali fraction measured by GrA-25389	From same context BM-2669	3980±50	−29.9			2620–2340	
GrA-25553	WH88 23207 (B4600)	Cattle. Proximal phalanx from same foot as another from same context (WH88 23201/B4613)	From same context as BM-2669. This sample and the other proximal phalanx from the same foot were not found in articulation, but *c.* 0.25 m apart, lying one at either end of cattle tibia shaft WH88 23200 (Whittle *et al.* 1999, fig. 78: 2, 5, 6)	4755±40	−22.5	4.4		3650–3370	*3605–3495* (*55%*) or *3455–3375* (*40%*)
GrA-25550	WH88 23059 (B3783)	Pig. L ilium from new-born piglet, many of whose bones were found together (hind legs, pelvis, some vertebrae, some ribs); finds 23059 (B3783), 23067 (B3817), ?23063 (B3792)	Outer Ditch V, Trench B, bone deposit in context 210 (Whittle *et al.* 1999, 86; Grigson 1999, 189). Stratified above context 229 and below context 227	4300±40	−21.5	6.1		3020–2870	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-13500	WH88 23113 (B429)	Dog. Metatarsal articulating with proximal phalanx 23107 (B560)	Outer Ditch V, Trench B, bone deposit 227 on surface of 210 (Whittle *et al.* 1999, 82–85, fig. 79: 36; Grigson 1999, 189, 231). There are 3 further dog proximal phalanges and 1 further metatarsal from same context (WH88 23078 (B478), 23103 (B468), 23157 (B470), 23159 (B443)), including an articulating metatarsal (23103) and phalanx (23078), probably from same foot as this sample (Whittle *et al.* 1999, 82–5, fig. 79: 30, 36, 46, 48; Grigson 1999, 189, 231). These were not articulated but lay in an area approx. 0.40 m across. The deposit included 1 sherd of Ebbsfleet Ware and 1 of Neolithic Bowl (Zienkiewicz 1999, 272, table 156). Stratified above layer 210 and below the interface of Smith's layers 3 and 4	4021±29	−21.0	9.1		2620–2460	
GrA-25367	WH57–58 B198	Human. Femur from infant skeleton, 7–7.5 months, articulated but partly disturbed by burrowing animal(s) (I. Smith 1965a, 9). Bones present were frontal, parietal, occipital, temporal, ribs, vertebrae, pelvis, humerus, radius, ulna, clavicle, femora, scapula, tibia, phalanges, and possibly tarsals, metatarsals and carpals (Brothwell 1965). Replicate of OxA-13759	Outer Ditch V, at interface of layers 4 and 3. Original section drawing in Alexander Keiller Museum, Avebury (acc. no 78510392), shows location approx. midway between outer edge and centre of ditch, at junction of lower and upper secondary fills. Stratified above context 227 and below Outer Ditch V layer 2	3640±50	−21.9		3698±24 T′=1.8; T′(5%)=3.8; ν=1	2200–1980	
OxA-13759	WH57–58 B198	Replicate of GrA-25367		3716±28	−20.5				
BM-75	Sample C	Bulk sample of unidentified charcoal	Outer Ditch V, layer 2, tertiary fill accumulated in ditch top. Peterborough Ware, Grooved Ware Beaker and early Bronze Age pottery present. Stratified above layer 4/3 interface	3500±150				2300–1400	

Reassessment and modelling of existing dates

Twenty radiocarbon measurements had thus been obtained for samples recovered from the causewayed enclosure at Windmill Hill before this project began (Table 3.2).

Three samples of bulk charcoal were dated by the British Museum Research Laboratory in the late 1950s (Barker and Mackey 1961). These were prepared and dated using GPC of acetylene as described by Barker and Mackey (1959). None of these samples was identified to age or species, and so they may have included material which was several centuries earlier than the deposits from which they were recovered. BM-73 came from a concentration of charcoal on the old land surface beneath Outer Bank V (I. Smith 1965a, 28), and so should provide a reliable *terminus post quem* for the construction of the outer circuit. BM-74 consisted of charcoal from what were thought to be the rapidly forming primary silts of the middle and outer ditches (layers 4 and 5 in Outer Ditch V, and equivalent deposits in Outer Ditch IV and Middle Ditch XII; I. Smith 1965a, 11). Since it was a bulk sample from more than one context, and since layer 4 in Outer Ditch V has now proved to be the fill of a recut (see below), we suggest (like Ambers and Housley 1999, 118) that it be excluded from the interpretation of the results from the site. BM-75 was a bulk charcoal sample from layer 2 in Outer Ditch V, which equates to Whittle's upper secondary fills (I. Smith 1965a, 11). It provides a *terminus post quem* for that layer.

Seventeen measurements were obtained on faunal remains from the 1988 excavations. Five were obtained by the British Museum Research Laboratory using LSC, and 12 by the Oxford Radiocarbon Accelerator Unit using AMS. The methods used for the production of these results, with an outline of the associated quality assurance procedures, are provided by Ambers and Housley (1999). Fifteen of the samples were single animal bones, none of which are recorded as articulated (although OxA-2401–2 came from bone deposit 321, a compact group almost entirely of cattle bones, many of which conjoined or were articulating). Strictly, therefore, these samples only provide *termini post quos* for the deposits from which they were recovered. The good agreement of these results with the relative chronology provided by stratigraphy and the consistency of these measurements with more recently selected articulated material suggest, however, that in fact few residual samples were dated (see below). The two other dated samples were of human bone. One was from an articulated skeleton from a grave beneath the outer bank (OxA-2403), which was thought to provide another reliable *terminus post quem* for the construction of the outer circuit (but see below). The other was a child's cranium in a bone deposit in Trench A of the outer ditch. The taphonomy of this latter sample is equivalent to that of the animal bone samples dated at this time.

A Bayesian chronological model which integrates the 20 radiocarbon measurements available in 1999 with the stratigraphic sequence is shown in Fig. 3.5. The overall form of the model and the relative dating included are discussed in detail below in relation to the main chronological model created for the site. In Fig. 3.5 we have assumed that all the disarticulated faunal material dated was freshly deposited in the context from which it was recovered. This assumption accords with the good overall agreement shown between the prior information and the radiocarbon data in this model ($A_{overall}$=94.0%; Bronk Ramsey 1995; and see Chapter 2.4.4). Four measurements have been excluded from the analysis: BM-74 because it was on bulked charcoal from more than one context; BM-75, which surely represents an accumulation of charcoals of varied histories and diverse ages rather than the product of a single event relating to the Neolithic use of the monument; and BM-2672–3 which appear to relate to episodes during the later silting of the ditches (see below).

This model suggests that all three circuits were dug between *c.* 3600 and *c.* 3400 cal BC (Fig. 3.6), providing a quantitative estimate for the date in the middle of the fourth millennium cal BC proposed by Ambers and Housley (1999, 119) for the main phase of construction and primary use of the enclosure. As they suggest, the fact that all the samples from the primary fills of the three ditches are statistically consistent (T'=9.6; $T'(5\%)$=12.6; ν=6), may suggest that the enclosure was laid out as one, or within a relatively short period of time. In contrast, the model shown in Fig. 3.5 does not support the suggestion that material continued to be deposited consistently in the ditches beyond the third quarter of the fourth millennium cal BC.

Objectives of the dating programme

Given the promising chronological modelling of the existing results from Windmill Hill, questions for the new dating programme included the date of construction of the enclosure as a whole and whether its constituent circuits could be seen to have been built at the same time or successively, and the duration of primary use. Our aim has also been to relate the dating of the Windmill Hill enclosure to that of other Neolithic monuments and activity in the area.

Sampling strategy and simulation

Based on the preliminary analysis of the existing data, a series of simulations were constructed to determine how many samples would be required from different parts of the enclosure circuits, in order to refine the chronology of the monument (e.g. Fig. 3.7). In addition to statistical criteria, consideration was given to obtaining sequences of samples from more than one segment in each circuit, and ideally samples from different parts of each circuit, in order to build an archaeologically representative sampling strategy. As already discussed in Chapter 2.4.2, our further aim at Windmill Hill was to use the knowledge of ditch stratigraphy provided by the excavations of the 1950s and 1980s to assess whether we could incorporate into a Bayesian framework the imperfect stratigraphic sequence obtained from digging in spits in the 1920s and 1930s.

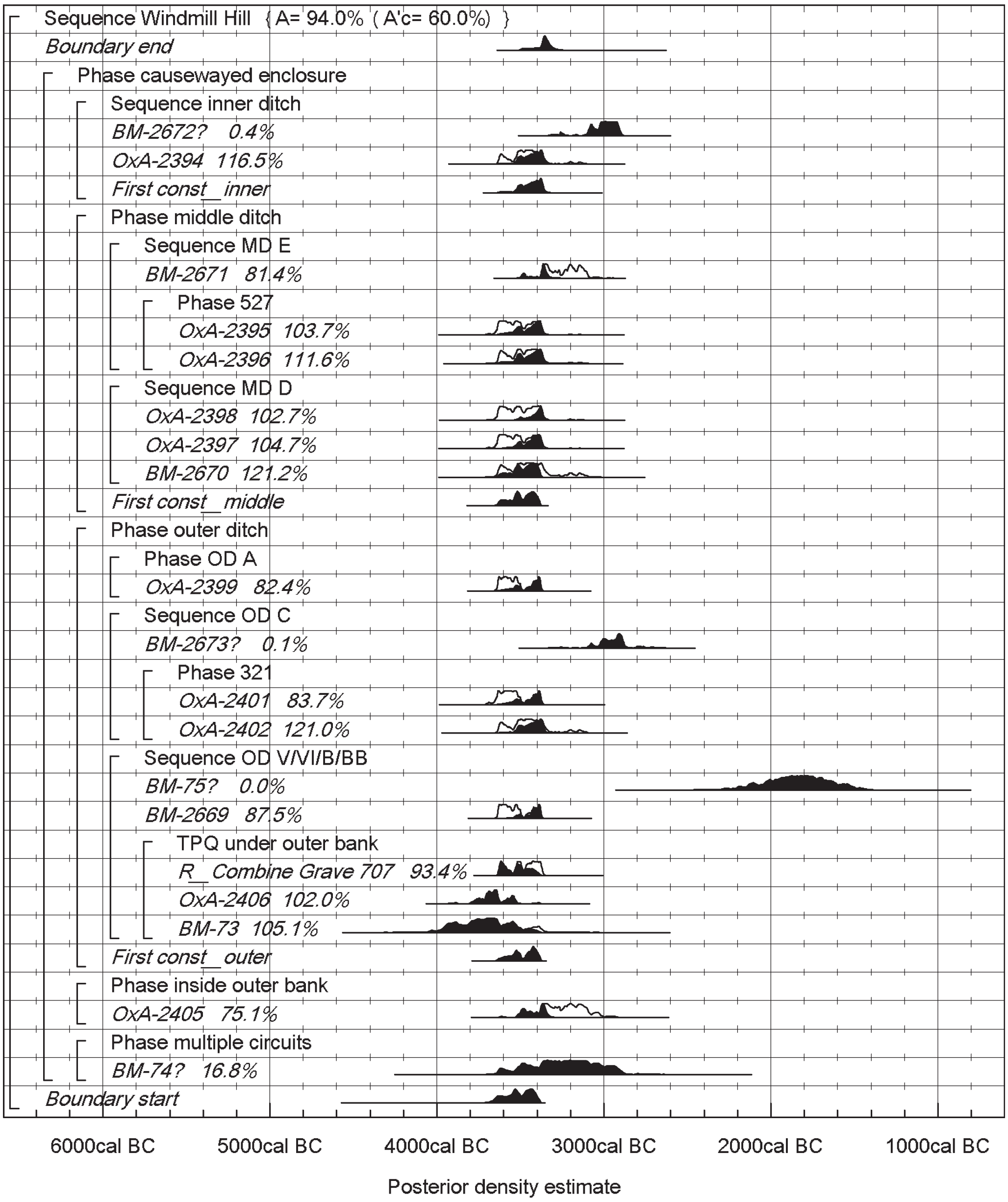


Fig. 3.5. Windmill Hill. Probability distributions of dates obtained before 1999. Each distribution represents the relative probability that an event occurred at a particular time. For each date two distributions have been plotted, one in outline which is the result produced by the scientific evidence alone, and a solid one which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution 'const_inner' is the estimated date for the digging of the inner ditch. Dates followed by a question mark have been calibrated (Stuiver and Reimer 1993), but not included in the chronological model for reasons explained in the text. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Results and calibration

Details of all the radiocarbon measurements from Windmill Hill are provided in Table 3.2.

Analysis and interpretation

Following the approaches set out in Chapter 2, the radiocarbon results from the Windmill Hill causewayed enclosure have been integrated with the stratigraphic and archaeological information available from the complex to provide an explicit and quantitative interpretation of the chronology of the monument. We discuss the reliability of this interpretation. We also consider the archaeological significance of the results for our understanding of the history and development of the monument itself, and, secondly, of chronological relations between the Windmill Hill circuits and other constructions in the local area.

Our main model for the chronology of the Windmill Hill enclosure is shown in Figs 3.8–11. The overall structure of the model is shown in Fig. 3.8. This is constructed on the premise that the primary use of the circuits from their initial construction to the end of the accumulation of chalk

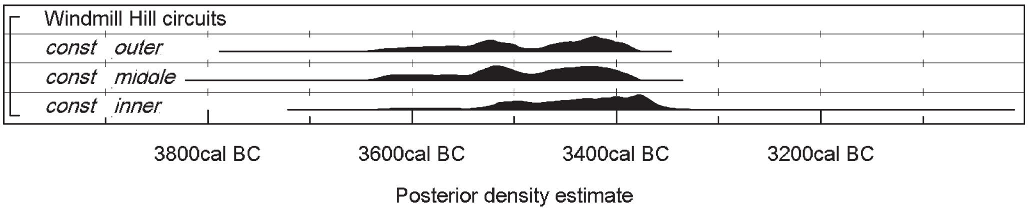


Fig. 3.6. Windmill Hill. Posterior density estimates for the cutting of each circuit, derived from the model shown in Fig. 3.5.

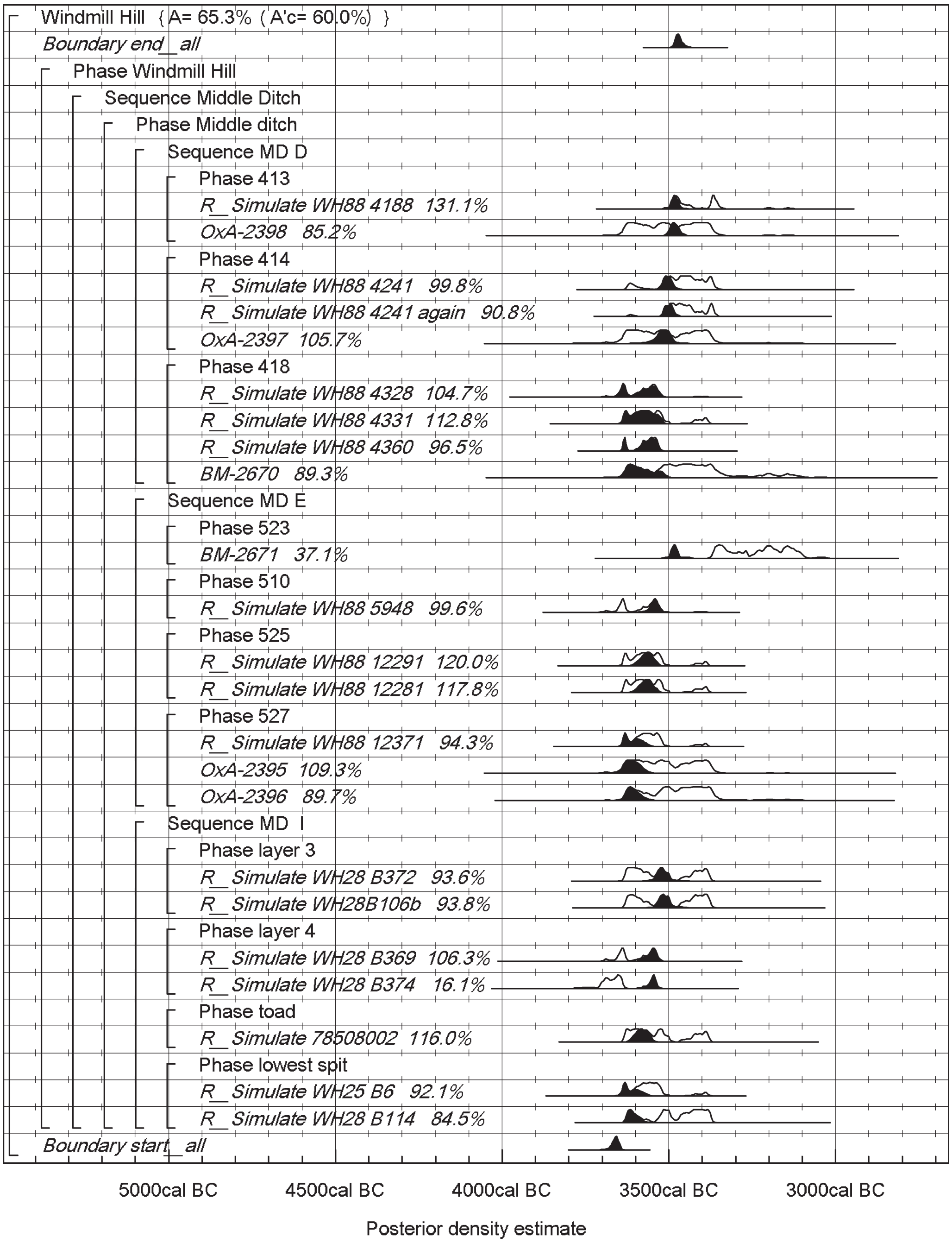


Fig. 3.7. Windmill Hill. Probability distributions of simulated dates from the Middle Ditch, part of one of the simulation models for the whole site. The format is identical to that of Fig. 3.5. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

rubble and the beginning of secondary silting forms a basically uninterrupted and continuous phase of activity. This model counteracts, as explained in Chapter 2.2, the inevitable statistical scatter on radiocarbon dates which makes it appear that phases began earlier and ended later than they did in reality, if no distribution is applied (Buck *et al*. 1992; Steier and Rom 2000; Bronk Ramsey 2000; Bayliss *et al*. 2007a).

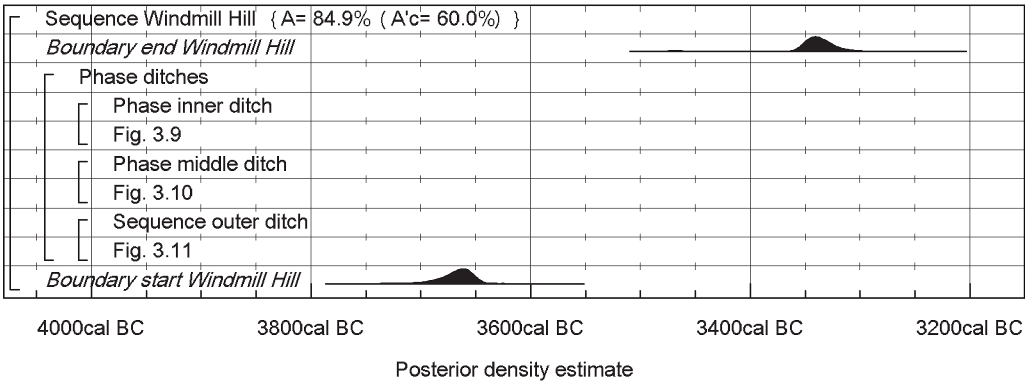


Fig. 3.8. Windmill Hill. Overall structure of the main chronological model. The component sections of this model are shown in detail in Figs 3.9–11. The format is identical to that of Fig. 3.5. The large square brackets down the left-hand side of Figs 3.8–11, along with the OxCal keywords, define the overall model exactly.

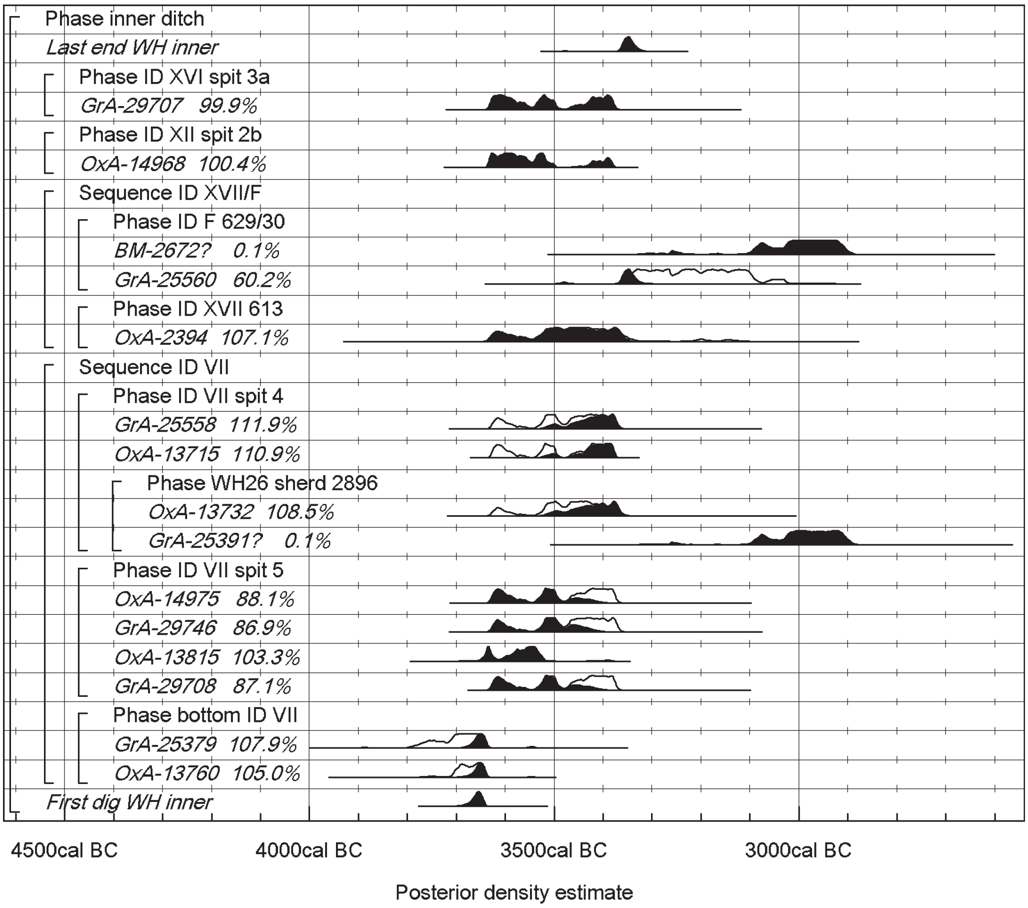


Fig. 3.9. Windmill Hill. Probability distributions of dates from the Inner Ditch. The format is identical to that of Fig. 3.5. The overall structure and other components of this model are shown in Fig. 3.8.

The inner ditch. Figure 3.9 shows the sequence of dated samples from the inner ditch. Despite the quantities of material recovered by Keiller from this circuit, it was difficult to find stratified sequences of suitable samples. Articulated samples were particularly scarce in this ditch (Grigson 1999, fig. 185). Nonetheless, it was possible to locate suitable series from three adjacent segments in the north-western part of the circuit (ID XVII sectioned by Isobel Smith in the 1950s and then by Alasdair Whittle in 1988 as Trench F; ID VII excavated by Keiller in 1926; and ID XVI excavated by him in 1929; Fig. 3.2). One further sample was dated from ID XII in the north-east, excavated by Keiller in 1929.

Two fragments of short-lived charcoal, recorded as coming from the bottom of Inner Ditch VII (Fig. 3.12: upper; J. Pollard 1999a, figs 50–2), produced two statistically consistent radiocarbon measurements (OxA-13760 and GrA-25379: T'=0.1; T'(5%)=3.8; ν=1). As this was a deposit

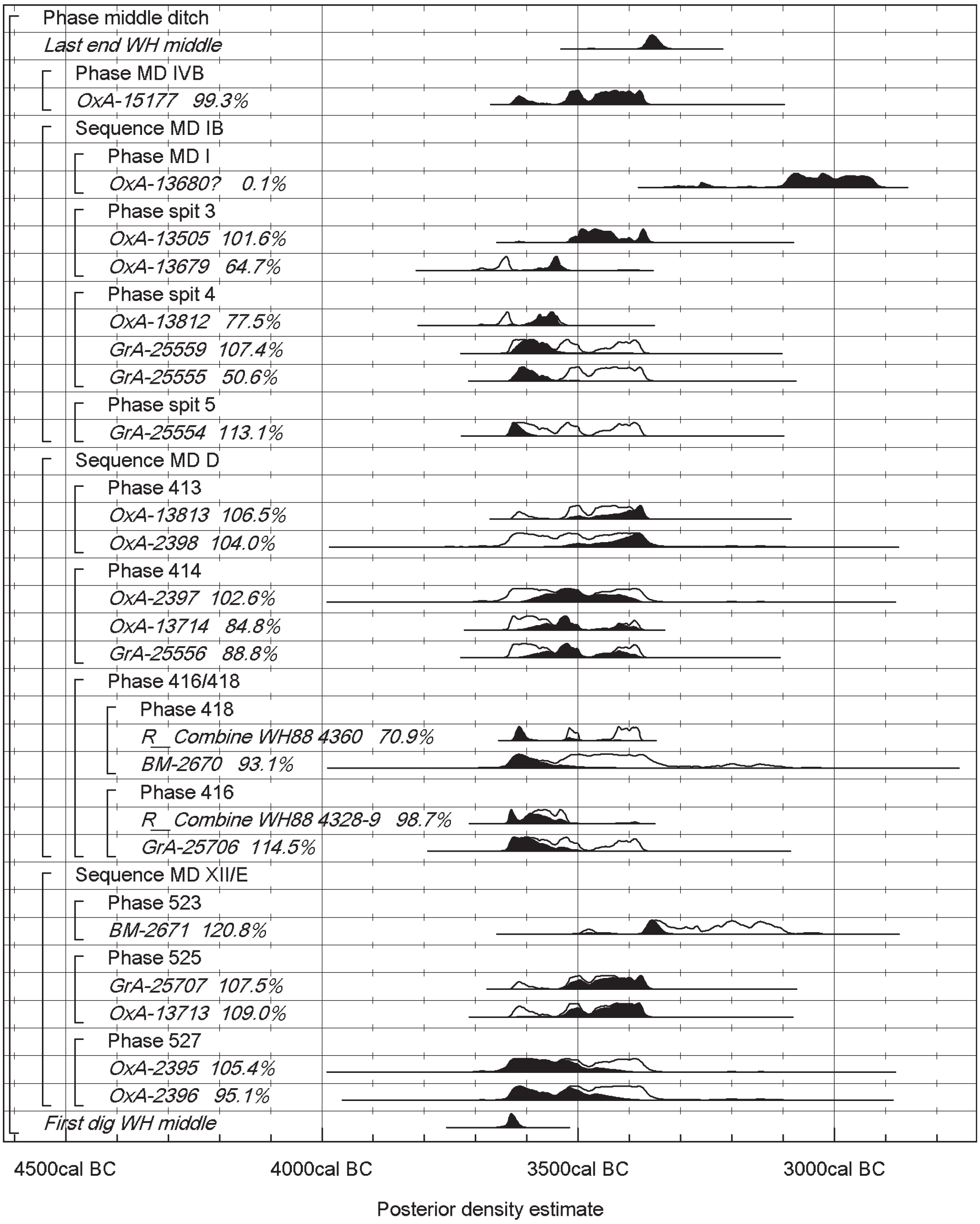


Fig. 3.10. Windmill Hill. Probability distributions of dates from the Middle Ditch. The format is identical to that of Fig. 3.5. The overall structure and other components of this model are shown in Fig. 3.8.

of comminuted chalk and charcoal hand-collected by Keiller, it is likely to have been coherent. The consistency of the radiocarbon results means that it is unlikely to have been redeposited or reworked material.

Probably slightly later than these fragments of charcoal, an antler pick (OxA-13815) and a worn antler tine probably from a second pick (GrA-29708) came from spit 5 (the lowest here, and entirely in chalk rubble), as did two fragments of short-lived charcoal from a second charcoal find, the collection of which suggests that it was a discrete concentration (OxA-14975 and GrA-29746). These four measurements are statistically consistent (T'=6.5; T'(5%)=7.8; ν=3), which may support the archaeological interpretation of these samples as freshly deposited.

Fresh material in spit 4 is likely to be later than the material from the bottom of the ditch. Three samples were dated from this level. A sheep/goat humerus articulating with a radius (OxA-13715) and a dog mandible (GrA-25558) found with associated skull fragments were dated from find B22, a concentration of bone in this spit. A third sample, a residue adhering to the internal surface of a group of refitting sherds, was dated twice (OxA-13732 and GrA-25391). Statistically inconsistent measurements were obtained on this sample (T'=21.4; T'(5%)=3.8; ν=1). The older of these results is consistent with the measurements on the articulating material from this spit (T'=0.5; T'(5%)=3.8; ν=2) and so may in fact be reliable (see Chapter 2.1). For this reason it has been included in the model.

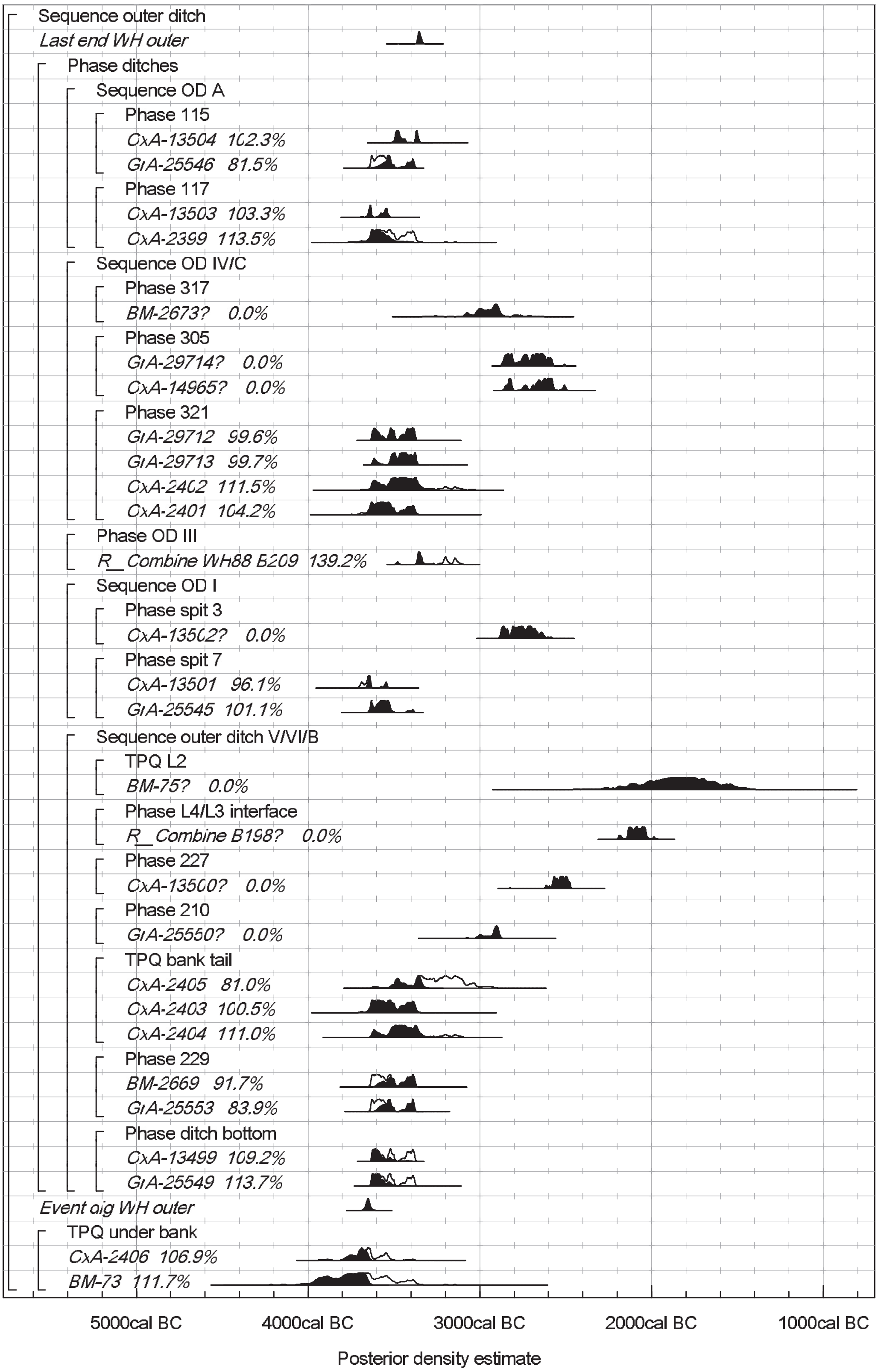


Fig. 3.11. Windmill Hill. Probability distributions of dates from the Outer Ditch. The format is identical to that of Fig. 3.5. The overall structure and other components of this model are shown in Fig. 3.8.

The results from Inner Ditch VII are in encouragingly good agreement with the relative dating suggested by the sequence of spits, given the arbitrariness of that method.

In Trench F across Inner Ditch XVII (Fig. 3.12: lower), there were no samples available from the ditch bottom, and only one disarticulated animal bone was present in the primary rubble fills (OxA-2394). It is impossible to demonstrate that this sample was not residual, although the

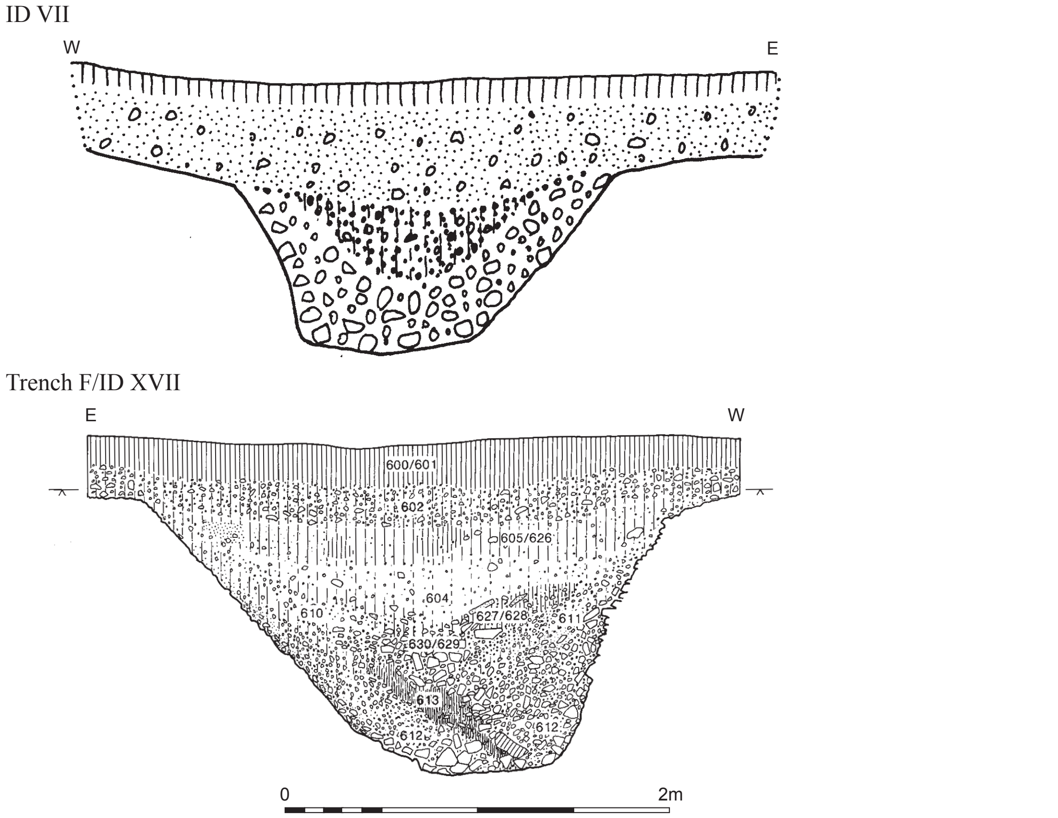


Fig. 3.12. Windmill Hill Inner Ditch. Sections of Inner Ditch VII and Trench F/Inner Ditch XVI. After Whittle et al. *(1999, figs 50 and 95).*

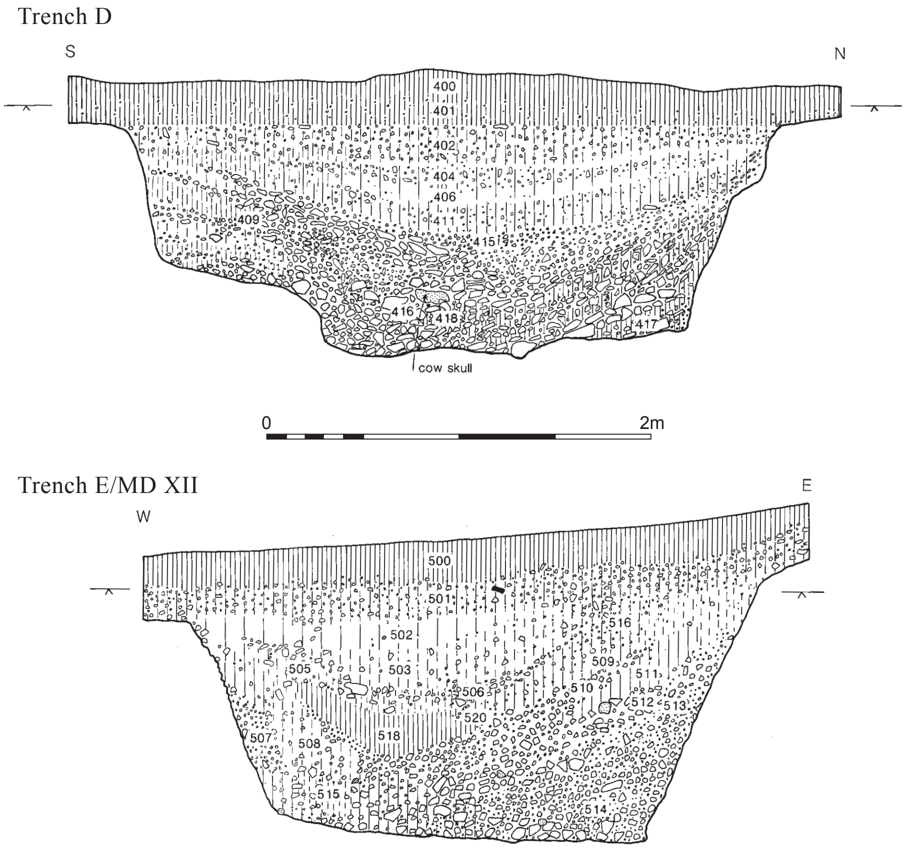


Fig. 3.13. Windmill Hill Middle Ditch. Sections of Trench E/Middle Ditch XII and Trench D. After Whittle et al. *(1999, figs 86, 89).*

measurement is statistically consistent with all the others from the primary rubble fill in the inner ditch (T'=8.6; T'(5%)=14.1; ν=7). It also has good agreement with the two samples higher up this section. For these reasons, it has been included in the model as a freshly deposited sample. Later than this sample, from bone group 630, there is a cattle metatarsal articulated with tarsals (GrA-25560; Whittle *et al*. 1999, figs 95, 97). A third measurement on a disarticulated cattle vertebra from bone deposit 629 was already available from this segment (BM-2672). The relationship between 629 and 630 is uncertain, allowing the possibility that 629 was later than 630, as suggested by the radiocarbon dates. If so, BM-2672 could be regarded as a deposit made sometime after the surface of the primary rubble fills had stabilised. In this case, BM-2672 is not part of the initial use of the circuit, and so it has been excluded from this model. In fact, if this sample is interpreted as part of the initial use of the enclosure, it has a very poor index of agreement (A=5.9%).

Two further articulating bone groups were located, in order to increase the number of samples from the inner ditch. From spit 3a in ID XVI, the middle spit of the segment, came a complete cattle femur (GrA-29707), articulating with a complete tibia. These almost certainly formed part of a bone group consisting of a cattle pelvis, femur, tibia, and astragalus, all complete and placed close together in the south-west butt of the segment (I. Smith 1965a, pl. Vb). From spit 2b in ID XII, the middle spit in a shallow segment, came two fitting pig metatarsals, one of which was dated (OxA-14968).

On the basis of the model shown in Figs 3.8–11, we estimate that the inner ditch was constructed in *3685–3635 cal BC* (*95% probability*; Fig 3.9: *dig WH inner*), probably in *3670–3645 cal BC* (*68% probability*). This estimate is based on a limited number of samples, but careful search of the archive has revealed no further samples which would make this dating any more robust.

The middle ditch. Suitable dating material was more abundant in this circuit. Samples were located from widely spaced parts of the circuit, from Middle Ditch I and IV on the east side, dug by Keiller in 1925 and 1928, and 1927 respectively, from MD XII/Trench E on the north-west side excavated by Smith and then Whittle, and from Trench D on the south-west side, excavated in 1988. The samples dated from the middle ditch are shown in Fig. 3.10.

In Middle Ditch XII, sectioned as Trench E in 1988 (Fig. 3.13: lower), three samples were dated from bone spread 527 within the primary chalk rubble (515) in Trench E. Two disarticulated pig bones produced statistically consistent results (OxA-2395–6: T'=0.1; T'(5%)=3.8; ν=1). This consistency may suggest that they are not residual. Two radiocarbon measurements have also been obtained on an articulated toad skeleton from the same deposit (Table 3.2: GrA-25368 and OxA-13730), although, as this toad lived during the first quarter of the second millennium cal BC, it must have burrowed into this deposit and is not shown on Fig. 3.10! In bone deposit 525 in the lower part of context 508 at the top of the primary fill (Whittle *et al*. 1999, 99–101, figs 89 and 93), articulating cattle carpals (OxA-13713) and contiguous cattle vertebrae and sacrum (GrA-25707) provided consistent radiocarbon measurements (T'=0.1; T'(5%)=3.8; ν=1). In bone deposit 523, in the top of context 510 (Whittle *et al*. 1999, figs 89 and 91), a disarticulated cattle humerus was dated (BM-2671). As this result shows good agreement with the stratigraphic sequence (A=120.8%), it may not have been residual and so has been included in the model as a freshly deposited sample.

Four samples have been dated from the primary chalk rubble (416) in Trench D (Fig. 3.13: upper; Whittle *et al*. 1999, fig. 86). Two samples came from bone deposit 418 in this layer. Five replicate measurements (UB-6186, GrA-29706, OxA-15075–6 and OxA-15088) have been made on an antler pick, producing statistically consistent results (T'=5.2; T'(5%)=9.5; ν=4), and BM-2670 is from a disarticulated cattle tibia. In 416, two articulating bone samples have been dated. Two statistically consistent measurements (T'=2.9; T'(5%)=3.8; ν=1) have been obtained on an articulating cattle radius and ulna (OxA-13814 and OxA-14967). A radius articulating with an ulna from a second animal was dated by GrA-25706. All nine measurements are statistically consistent (T'=14.1; T'(5%)=15.5; ν=8), suggesting that the cattle tibia dated by BM-2670 was not residual. For this reason it has been included in the model as a freshly deposited sample.

Above this in bone deposit 414 within the secondary fill layer 411, three radiocarbon measurements have been obtained. Two of the samples (OxA-13714 and GrA-25556) were separate ribs from a deposit of several interleaved rib fragments, probably from not more than two ribs (Whittle *et al*. 1999, 97, fig. 87) and provided statistically consistent measurements (T'=0.0; T' (5%)=3.8; ν=1). A cattle scapula (OxA-2397) also from context 414 was probably not residual, as its measurement is consistent with those from the two other samples from this context (T'=0.1; T'(5%)=6.0; ν=2). In bone deposit 413, directly above 414 within 411, two samples have been dated (OxA-13813 and OxA-2398). These produced statistically consistent radiocarbon measurements (T'=0.1; T'(5%)=3.8; ν=1), suggesting that the disarticulated sample OxA-2398 (a cattle calcaneum, possibly of an aurochs) was not residual. OxA-13813 was one of four fragmentary cattle dorsal vertebrae found in close proximity, probably articulating.

Middle Ditch I was excavated in two stages. The north terminal was dug by Gray in 1925 and the remainder, Middle Ditch IB, by Keiller in 1928 (J. Pollard 1999a, 47–51, fig. 41). A single sample (OxA-13680) was dated from a depth of 4 feet (1.20 m) in Gray's cutting, MD I, either from the top of the primary chalk rubble or the base of the secondary fills (J. Pollard 1999a, fig. 42). If this measurement is included in the initial phase of enclosure use, it has poor agreement (A=10.1%). This may suggest that it was in fact from the secondary fill, and so it has not been included in the model. In MD IB a modified antler fragment from the lowest spit (5A), which may have been used in the digging of the segment, was dated (GrA-25554).

Three samples were dated from the overlying spit 4. Two sets of articulating cattle carpals from different animals (GrA-25559 and GrA-25555), and vertebrae and longbones from a single toad (OxA-13812) produced statistically inconsistent measurements (T'=8.1; T'(5%)=6.0; ν=2). These measurements are, however, in good agreement with the samples from the overlying spit 3. OxA-13505 came from articulating metacarpals from a substantial if not complete articulated dog skeleton, and OxA-13679 from an articulating cattle carpal from a third animal. The pattern of results from the entire segment shows good overall agreement with the relative dating inferred from the recorded spits, despite the obvious limitations of the spit method.

In MD IVB the humerus of a partial cattle skeleton from the bottom two spits of the segment was dated (Murray 1999, fig. 44; OxA-15177). This date was obtained to extend the spatial distribution of sampling.

On the basis of the model shown in Figs 3.8–11, we estimate that the middle ditch was constructed in *3655–3605 cal BC* (*95% probability*; Fig. 3.10: *dig WH middle*), probably in *3640–3615 cal BC* (*68% probability*).

The outer ditch and bank. Material was also abundant in this circuit. Samples were available from five separate locations: OD V/Trench B/Trench BB excavated by Smith in 1957–8 and Whittle in 1988; OD I excavated by Keiller in 1925, 1927 and 1928; OD III dug by Keiller in 1929; OD IV/Trench C dug by Smith and then Whittle; and Trench A dug in 1988. The first four locations are on the north-east arc of the outer circuit, while Trench A was on its south side. The model for the outer ditch samples is shown in Fig. 3.11.

Five measurements were obtained from the buried soil under the outer bank in Trench V and the adjacent Trench BB (Fig. 3.14), two of which were securely stratified under the clearly bedded outer portion of the bank close to the ditch. BM-73 was a bulk sample of unidentified charcoal (I. Smith 1965a, 28), from a single point clearly marked on an archive section and therefore probably from a concentration of charcoal. OxA-2406, a disarticulated cattle vertebra, came from the surface of the buried soil (context 747) beneath the 'marking out bank' (context 750; Whittle *et al*. 1999, 350). Both of these results have been used as *termini post quos* for the construction of the circuit. These samples must also be earlier than the two statistically consistent measurements (T'=0.1; T'(5%)=3.8; ν=1) on sherds with residues from the bottom of the ditch in Outer Ditch V (OxA-13499 and GrA-25549). These samples were carbonised residues adhering to the interior surface of two plain shell-tempered Bowl sherds. The freshness of their surfaces and fractured edges, and the preservation of the residues, suggest that the sherds were buried rapidly, since the soft, shelly fabrics and fine sooty residues would have degraded rapidly if exposed to weathering. The residue is likely to derive from the last use of the pot or pots from which the sherds came, and thus to be close in age to their context.

A very little above the base of the outer ditch in the immediately adjacent Trench B, in bone deposit 229 (Fig. 3.14), two statistically consistent measurements (T'=0.1; T'(5%)=3.8; ν=1) were obtained on two cattle bones. BM-2669 was on a disarticulated tibia and GrA-25553 on a proximal phalanx. There was another phalanx from the same foot in the same context, and their proximity suggests that they were not long out of articulation when buried and hence were close in age to their context. The consistency of these measurements may also suggest that BM-2669 was fresh when buried. For this reason it has been included in the model as a freshly deposited sample. Three measurements (OxA-13561, GrA-25389 and GrA-25821) were obtained from carbonised residues adhering to the interior surfaces of sherds from a substantial portion of single plain bowl (Zienkiewicz 1999, fig. 187: 516). These results are statistically significantly inconsistent (T'=391.2; T'(5%)=6.0; ν=2)! It is apparent that the residue on this pottery contains some younger chemical contaminant which has not been adequately removed by either radiocarbon laboratory (see Chapter 2.7). For this reason these results have been excluded from the model and are not shown on Fig. 3.11.

Still in the lower part of the outer ditch in Trench B, one of many bones from a newborn piglet, the completeness of which suggests that it was articulated or largely so when buried, was dated (GrA-25550). This came from context 210, smaller chalk rubble (Whittle *et al*. 1999, 86). Immediately above, from bone deposit 227, on the surface of context 210, a dog metatarsal articulating with a proximal phalanx was dated (OxA-13500). There were other dog phalanges and a further metatarsal from a small area in the same context (Grigson 1999, 189, 231). Their proximity and good condition suggest that they had been disarticulated for only a short time and were close in age to their context. The striking interval between GrA-25550 and *GrA-25553* and *BM-2669* (Fig. 3.11) compared with the shallowness of the basal deposit in the ditch (Fig. 3.14) very strongly suggests that there must have been a major recut of the original primary fill, as far down as the top of 228 (Whittle *et al*. 1999, fig. 77), at some stage between *3605–3495 cal BC* (*55% probability*) or *3455–3375 cal BC* (*40% probability*; Fig. 3.11: *GrA-25553*) and 3020–2870 cal BC (95% confidence; GrA-25550; Table 3.2). The probability of a recut is reinforced by the date of OxA-13500, from above GrA-25550 (Fig. 3.11), by the much greater amounts of chalk rubble in the lower fills of other outer ditch segments, for example in Trenches A and C (Whittle *et al*. 1999, figs 81 and 83) and OD I and III (J. Pollard 1999a, fig. 26), and by earlier fourth millennium cal BC dates from relatively high in the fills in Trenches A and C (Fig. 3.11). A further recut can clearly also be suggested in OD IIIB (Fig. 3.14; J. Pollard 1999a, 30, and fig. 26, top right).

Higher up, in Outer Ditch V, immediately adjacent to Trench B, at the interface of Smith's layers 4 and 3, two statistically consistent measurements (T'=1.8; T'(5%)=3.8; ν=1) were obtained from the femur of an articulated infant skeleton (GrA-25367 and OxA-13759; Table 3.2). The

archive section drawing shows its location approximately midway between the outer edge and the centre of the ditch, at the junction of the lower and upper secondary fills; this is probably equivalent to the surface of context 203 in Trench B. The date of 2200–1980 cal BC (95% confidence; Fig. 3.11: B198) adds a further dimension to the already richly documented Beaker period activity on the hill, and additionally gives further support to the interpretation of a major recut lower in the fill.

From layer 2 of Outer Ditch V, in tertiary fill at the top of the ditch, with Peterborough Ware, Grooved Ware, Beaker and Early Bronze Age pottery all present, a bulk sample of unidentified charcoal was dated (BM-75) (I. Smith 1965a, 11). This sample provides only a *terminus post quem* for the tertiary silting above this level.

Finally, returning to the outer bank in Trench BB, a measurement (OxA-2405) was obtained on a disarticulated cattle humerus from the surface of the buried soil (context 705) sealed by the tail of the bank, probably beyond the limits of the original bank (*contra* Whittle *et al*. 1999, 73–82, and figs 69–71). From the grave (context 707) under the outer bank, two measurements were obtained, from the rib of the articulated adult male in the base of the grave (OxA-2403) and a pig scapula from the upper fill of the grave (OxA-2404). Although at the time of excavation it was assumed that the grave was sealed by a unitary outer bank, the published sections (Fig. 3.14: bottom; Whittle *et al*. 1999, fig. 70; I. Smith 1965a, fig. 4) allow for the grave being under the undifferentiated inner part of the bank (I. Smith 1965a, fig. 4; Whittle *et al*. 1999, fig. 70). It could therefore have been beyond the original bank and the date of *OxA-2403* strongly suggests that it was later than the putative original bank. The date of *OxA-2405* supports the interpretation of the bank as having two major phases of construction, since if this measurement is included in the model as earlier than the sherds with residues on the bottom of the ditch, this sample has a poor index of agreement (A=21.7%). The recutting of the ditch could thus have been accompanied by the dumping of chalk rubble from it on to the rear of the bank. This interpretation is incorporated into the model with *OxA-2403–5* providing *termini post quos* for the major recut in the adjacent ditch.

These reassessments have considerable implications for the interpretation of not only the outer circuit itself, but the wider history of the enclosure as a whole and the development of its associated material culture. They are discussed further below.

In Outer Ditch IB (Fig. 3.14), two statistically consistent measurements (T'=2.3; T'(5%)=3.8; ν=1) were obtained on articulating samples from spit 7, within the primary chalk fill at a depth between 1.8 and 2.1 m (J. Pollard 1999a, fig. 26, top left). OxA-13501 was made on one of several immature cattle caudal vertebrae and GrA-25545 on one of two articulating cattle carpals, with a further articulating metacarpal recovered in the immediately overlying spit 6. The recovery of small fragile vertebrae together with their unfused epiphyses indicates that they were probably articulated when buried, while the carpals too were probably articulated and thus also close in age to their context. In spit 3 at a depth of 0.6–0.9 m, one of two red deer phalanges, likely to have been side by side in the same foot, was dated (OxA-13502). The match of the phalanges suggests that they may have been articulated or only recently disarticulated when buried. Spit 3, however, was high up and cut across several layers coming in principally from the inner side of the ditch, and so the context of this sample must be uncertain. OxA-13502 is thus plausibly from the secondary silts and does not form part of the initial use of the outer ditch circuit. It has been excluded from the model.

A single sample was dated from the base of Outer Ditch IIIB, a relatively elevated part of the segment between two deeper sub-segments (J. Pollard 1999a, figs 25–6 and 29). This articulated child burial provided two statistically consistent measurements (OxA-14966 and GrA-29711; Fig. 3.11: *WH29 B209*: T'=3.1; T'(5%)=3.8; ν=1). It does not appear to date to the period of construction. It may be that either two separate segments were subsequently joined and the burial was placed in this linking cut, or alternatively a recut in OD IIIB (J. Pollard 1999a, fig. 26) may in fact have gone deeper than is shown in the published drawing, which was constructed not in the field, but from measurements (Fig. 3.14; J. Pollard 1999a, 30).

In Trench C adjacent to Outer Ditch IV (Fig. 3.14), four statistically consistent measurements (T'=1.8; T'(5%)=7.8; ν=3) were obtained on four cattle bones from bone deposit 321 in context 320, secondary silts directly overlying primary chalk rubble and silt: an astragalus (OxA-2401); a humerus (OxA-2402), a cattle metatarsal shaft with fitting unfused epiphyses articulating with two tarsals (GrA-29712); and one of three articulating cattle dorsal vertebrae (GrA-29713). OxA-2401–2 were themselves disarticulated, but came from this compact group which was almost entirely composed of cattle bones, many of them conjoining or articulating, and it is therefore likely that they too were fresh when buried (Whittle *et al*. 1999, figs 83–4). Two statistically consistent measurements (T'=0.4; T'(5%)=3.8; ν=1) were obtained on single fragments of short-lived charcoal (GrA-29714 and OxA-14965), from what was believed at the time of submission to be from context 308. These results are surprisingly late and have very poor agreement with their stratigraphic position. On further checking, OxA-14965 proved to be from 305, and it is plausible that both these samples were in fact from context 305. Much higher up, from the mixed-origin bone deposit 317 (Whittle *et al*. 1999, 94) at the base of context 316, an incipient soil which formed over the secondary fills, a cattle scapula was dated (BM-2673). This has also been excluded from the model, because it does not relate to the main use of the outer ditch circuit. It must be residual as it is older than the two charcoal samples below it.

In Trench A in the south of the circuit, two statistically consistent measurements (T'=0.9; T'(5%)=3.8; ν=1) were obtained from bone deposit 117 in the top of context 112, chalk rubble about 1 m above the base of the steep-sided ditch. The samples were a human cranium (OxA-2399) and a cattle metatarsal articulating with two tarsals (OxA-

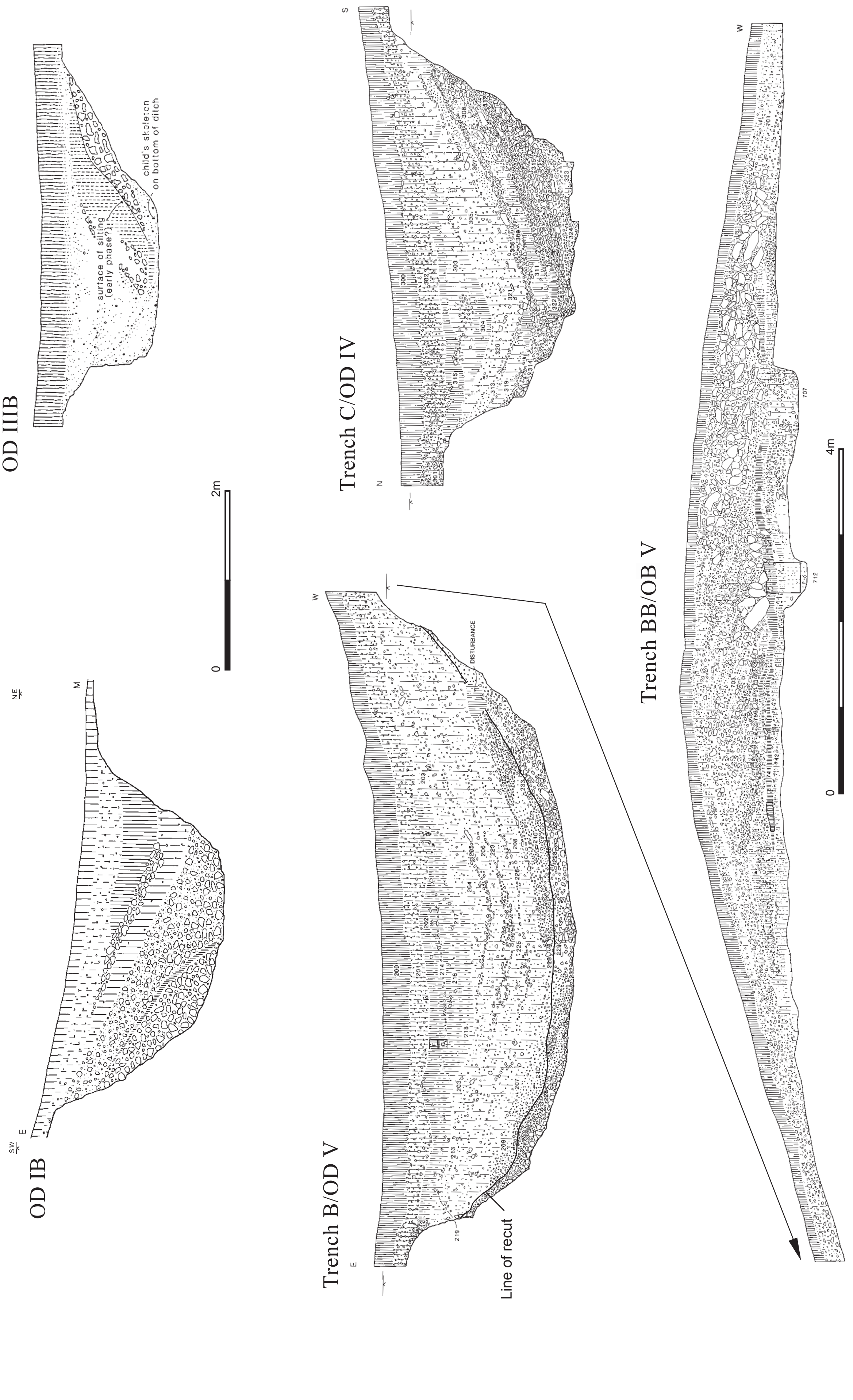


Fig. 3.14. Windmill Hill Outer Ditch. Sections of Outer Ditch IB and IIIB, Trench C/Outer Ditch IV, Trench B/Outer Ditch V and Trench BB/Outer Bank V, showing locations of samples and retrospectively identified recut in Trench B. After Whittle et al. *(1999, figs 26, 83, 77, 70).*

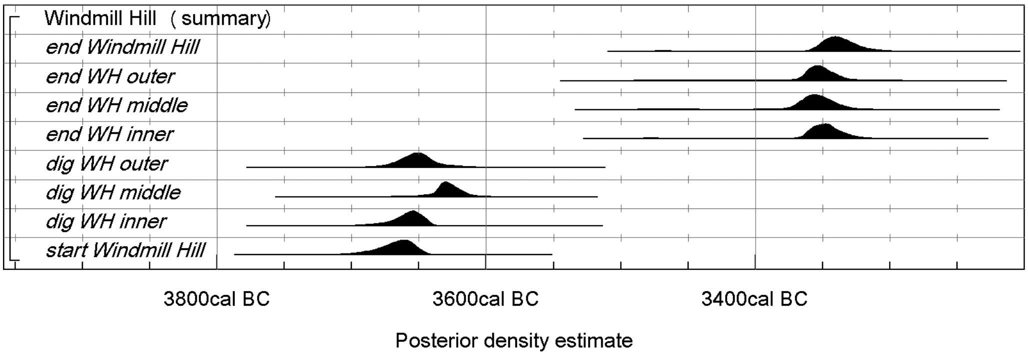


Fig. 3.15. Windmill Hill. Probability distributions of key parameters. The format is identical to that of Fig. 3.5, derived from the model defined in Figs 3.8–11.

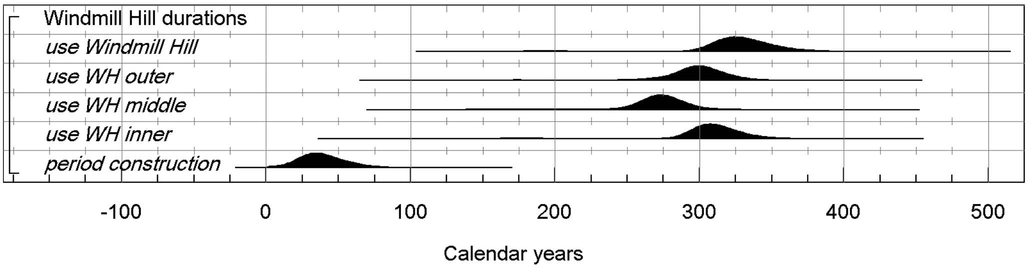


Fig. 3.16. Windmill Hill. Probability distributions of the number of years during which various activities occurred. The format is identical to that of Fig. 3.5, derived from the model defined in Figs 3.9–11.

13503) (Whittle *et al.* 1999, figs 81 and 82: 4). The fact that the results from these are consistent may suggest that the detached cranium may also have been freshly deposited. A little higher, two statistically inconsistent measurements (T'=8.2; T'(5%)=3.8; ν=1) were obtained from large mammal rib fragments in bone group 115 in the top of context 111 (GrA-25546 and OxA-13504). The rib fragments were both from the same interleaved deposit, possibly a small bundle (less substantial than that in the middle ditch in Trench D), and were earlier interpreted as having been probably discarded together when still attached by ligaments or bound together (Whittle *et al.* 1999, 90). In the light of these results, this must now be open to doubt.

On the basis of the model shown in Figs 3.8–11, we estimate that the outer circuit was constructed in *3685–3610 cal BC* (*95% probability*; Fig. 3.15: *dig WH outer*), probably in *3670–3635 cal BC* (*68% probability*).

An interpretive chronology

The first circuit at Windmill Hill was excavated in *3700–3640 cal BC* (*95% probability*; Fig. 3.15: *start Windmill Hill*), probably in *3680–3650 cal BC* (*68% probability*). The inner ditch was constructed in *3685–3635 cal BC* (*95% probability*; Fig. 3.15: *dig WH inner*), probably in *3670–3645 cal BC* (*68% probability*). The outer circuit was constructed in *3685–3610 cal BC* (*95% probability*; Fig. 3.15: *dig WH outer*), probably in *3670–3635 cal BC* (*68% probability)*. The middle circuit was constructed in *3655–3605 cal BC* (*95% probability*; Fig. 3.15: *dig WH middle*), probably in *3640–3615 cal BC* (*68% probability*). It is 69% probable that the inner ditch was dug first, and it is 88% probable that the middle ditch was dug last. Overall the construction order inner-outer-middle is 59.9% probable (Figs 3.15 and 3.17), with the principal uncertainty lying in whether the outer ditch is earlier than the inner. By calculating the difference between the date when the last, middle (*dig WH middle*) circuit was dug, and the date when the first circuit was dug (*start Windmill Hill*), an estimate of the period over which the monument was completed can be made. All three ditches appear to have been dug in the 37th century cal BC over a period of *5–75 years* (*95% probability*; Fig. 3.16: *period construction*), or *20–55 years* (*68% probability*). It is perfectly possible that the monument was built within the lifespan of a single individual, or over two generations (Fig. 3.16).

The main use of the Windmill Hill enclosure as represented by this selection of non-residual and short-life samples from the primary and lower secondary ditch fills continued for *180–200 years* (*1% probability*; Fig. 3.16: *use Windmill Hill*) or *290–390 years* (*94% probability*), probably for *305–350 years* (*68% probability*). It appears that this phase of deposition ended in *3475–3460 cal BC* (*1% probability*; Fig. 3.15: *end Windmill Hill*) or *3365–3295 cal BC* (*94% probability*), probably in *3355–3325 cal BC* (*68% probability*). The model estimates that this main phase of deposition ended in all three ditches in the middle decades of the 34th century cal BC (Fig. 3.15). This ending seems to represent a change in the use of the enclosure, rather than a complete cessation of activity. Perhaps people now came to this place with other intentions and motives. This may not have been a straightforward shift. The dating seems to indicate less frequent deposition of articulated bone (and perhaps other bone too), but the quantities of other material

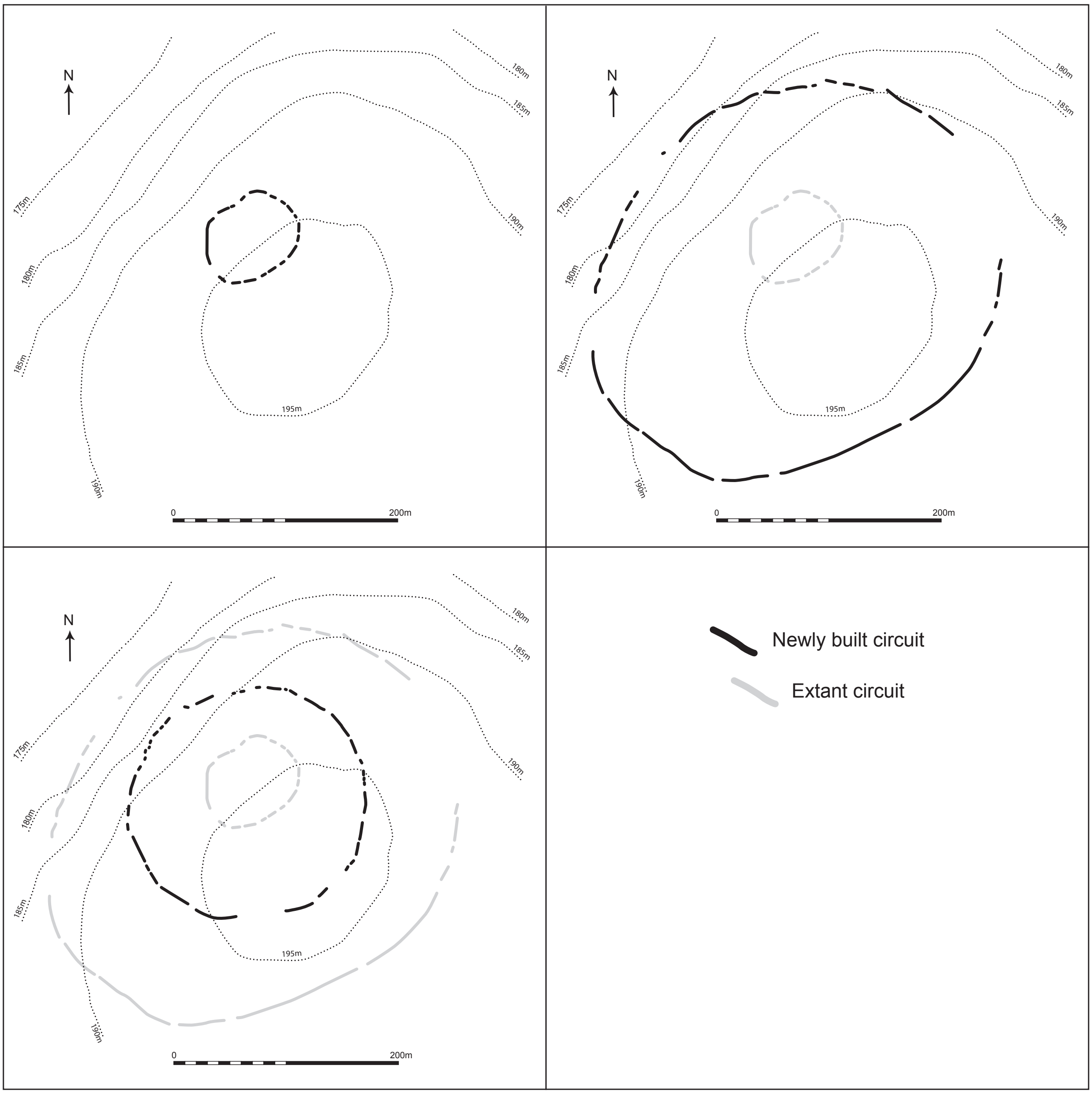


Fig. 3.17. Windmill Hill. Phase plan.

culture from lower secondary fills remain substantial (Whittle *et al*. 1999, tables 1–43, 155–61, 164–66, 173–9). In this scenario it is necessary to define a point of transition between these two types of activity, when the initial use of the circuits as first built ceased, and later practices began. This is required to enable the statistical model to counteract the scatter on the radiocarbon determinations, which would otherwise suggest a falsely extended chronology for the monument (see again Chapter 2.2).

Later activity is represented in the ditches of the causewayed enclosure. It is possible that there was something of a hiatus during the last third of the fourth millennium cal BC. Only three, possibly four, samples date to this period (GrA-25560, BM-2671, OxA-2405 and possibly WH29 B209). All these samples have been included in the initial phase of activity following construction and, being so few in number, are treated as scattered measurements falling on to the 3300–3000 BC calibration plateau (Reimer *et al*. 2004). If, however, these four samples are interpreted as part of the later, less intense, activity on the hill and excluded from the model then our estimates for when this main phase of activity ceased shifts into the 35th century cal BC (Fig. 3.18). This model also has good overall agreement ($A_{overall}$=83.9%). In contrast our estimates for the date of construction of the circuits are practically unchanged.

Whether or not there was a hiatus in the latter part of the fourth millennium cal BC or simply much reduced activity, more was happening here in the first half of the third millennium cal BC. This is when there was a major recut in Outer Ditch V/B (i.e. down to the top of 228), probably dated to 3020–2870 cal BC (95% confidence; Table 3.2: GrA-25550). This recut seems then to have

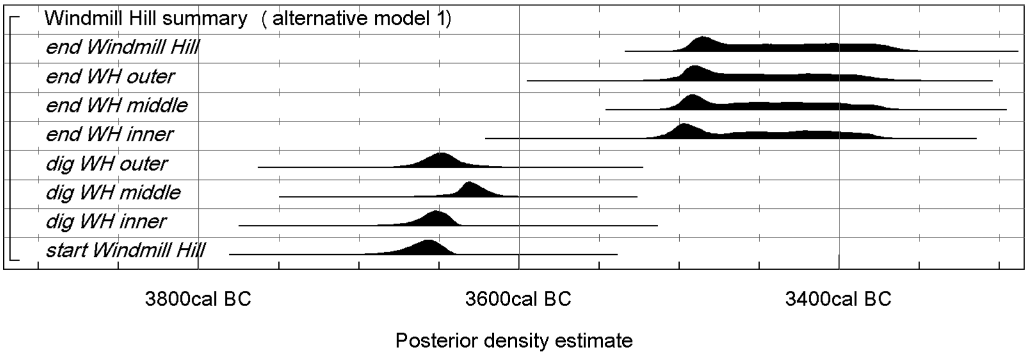


Fig. 3.18. Windmill Hill. Probability distributions of key parameters derived from alternative model 1. The format is identical to that of Fig. 3.5. The model is that defined in Figs 3.8–11, except that GrA-25560, BM-2671, WH88 B209 and OxA-2405 are not included in the phase of initial use of the causewayed enclosure.

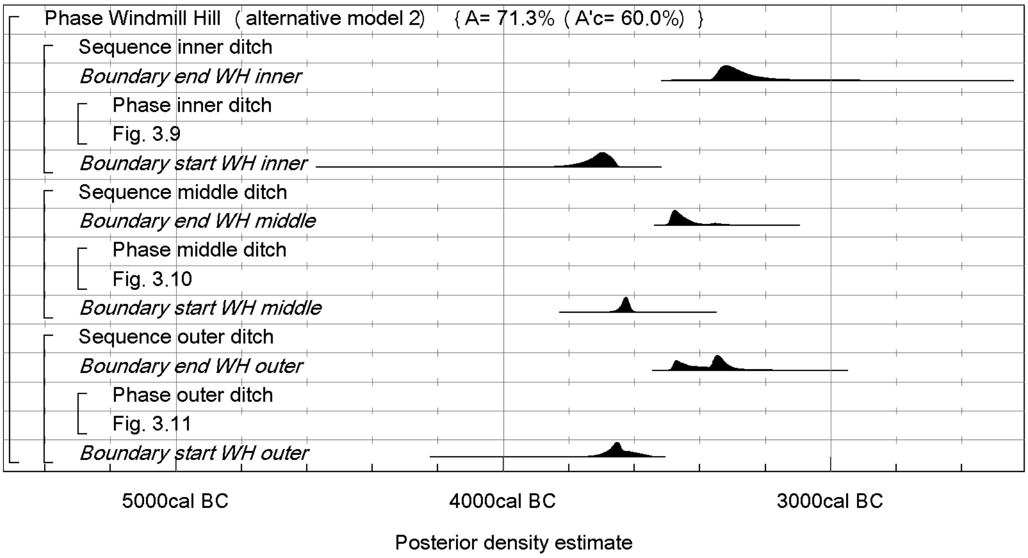


Fig. 3.19. Windmill Hill. Overall structure of alternative model 2. The structures of the component sections are shown in detail in Figs 3.9–11 (although the posterior density estimates shown on these figures are not those relating to this model). The format is identical to that of Fig. 3.5. The large square brackets down the left-hand side of Figs 3.9–11 and 3.19, along with the OxCal keywords, define the overall model exactly.

silted very slowly (i.e. the accumulation of 210), up to the level of OxA-13500 (95% confidence; 2620–2460 cal BC: Table 3.2). These articulating dog remains on the surface of 210 were part of a bone group which contained a single Ebbsfleet sherd, while more sherds from the same Ebbsfleet vessel were found at an equivalent level in the adjacent cutting of Isobel Smith (I. Smith 1965a, fig. 4). We discuss this further below. Other material dating to the earlier third millennium cal BC consists of scattered activity within the secondary fills of the ditches (e.g. the matching deer phalanges in OD I, and the charcoal in OD IV/Trench C, context 305).

Although activity continued into the third millennium cal BC and beyond, as seen in the abundant finds of later Neolithic and Early Bronze Age pottery, and associated animal bone, we have chosen in this project, with the resources available to us, not to date this material to any extent. We can note, however, the child burial dated to 2200–1980 cal BC (95% confidence; Table 3.2: GrA-25367) from the surface of layer 4 in OD V, which we sampled before the existence of the major recut in the outer ditch had been realised.

Sensitivity analyses

We have already presented one alternative model, in which the archaeological definition of the uniformly distributed phase of initial use of the enclosure has been varied (Fig. 3.18). To investigate further how much the results of the main model are affected by changing the 'uninformative' prior distributions used in the modelling (see Chapter 2.4.1), a second alternative model has been constructed.

The overall structure of this model is shown in Fig. 3.19. The component sequences for each ditch circuit are identical to those in the main model (Figs 3.9–11), so none of the 'informative' prior information has been varied. In this second alternative model, each of the three ditch circuits is placed in a separate, uniformly distributed, phase of activity. This means that in effect they are being treated as entirely separate monuments, the use of one

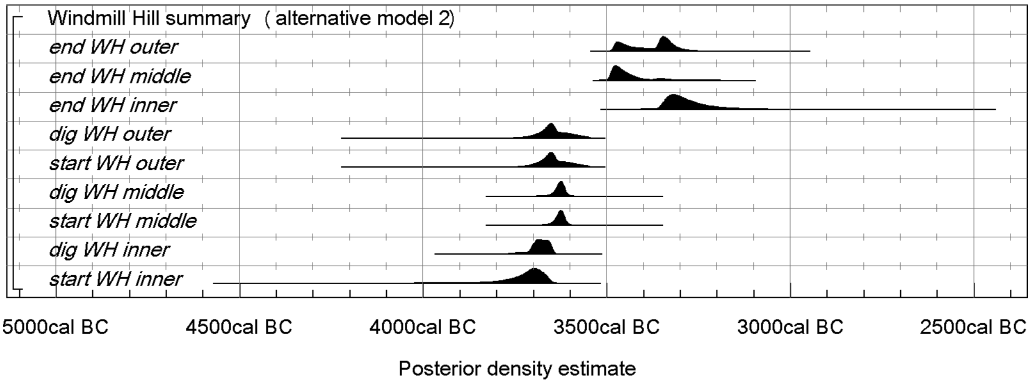


Fig. 3.20. Windmill Hill. Probability distributions of key parameters derived from alternative model 2 (Figs 3.19 and 3.9–11). The format is identical to that of Fig. 3.5.

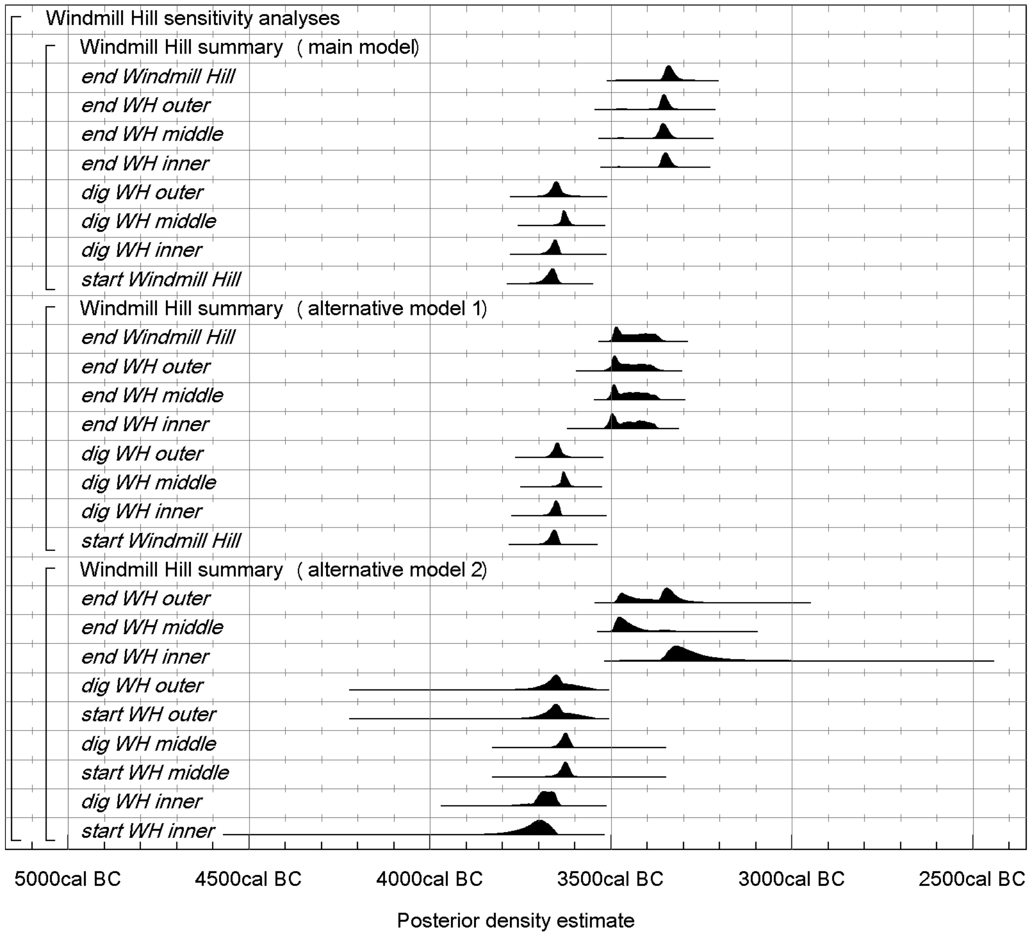


Fig. 3.21. Windmill Hill. Probability distributions of key parameters derived from the main model (Figs 3.8–11), alternative model 1 (Figs 3.8–11, except that GrA-25560, BM-2671, WH88 B209, and OxA-2405 are not included in the phase of initial use of the causewayed enclosure), and alternative model 2 (Figs 3.19 and 3.9–11). The format is identical to that of Fig. 3.5.

having no influence or effect on another. Because of this, fewer measurements are utilised in the estimation of the chronology of each ditch. For this reason, the posterior estimates of key parameters are rather less precise than for the other models. It can be seen, however, that the construction of all three ditch circuits is still firmly placed in the 37th century cal BC, and it is still probable that the inner ditch was constructed first and the middle ditch last (Fig. 3.20). Again, our estimates for the time when the main phases of use of the circuits ended (perhaps, again, more a point of transition) are more variable (Fig. 3.20). This model is not, however, our preferred interpretation, because we believe that it is unrealistic to suppose that in fact these closely spaced and concentric circuits could have been conceived of and constructed without reference to one another.

The key parameters from all three models presented here are shown in Fig. 3.21. It can be seen that our estimates for

the dates when the circuits were constructed are remarkably similar. We therefore have faith in the reliability of these estimates. In contrast, our estimates for when the intensive initial use of the circuits ended vary widely. Cautiously, perhaps we should simply say that this activity probably ended some time during the 35th or 34th century cal BC.

Implications for the site

The dating programme changes practically every aspect of the interpretation of Windmill Hill in one way or another. Far beyond the fact that we can now place its construction in the 37th century cal BC and the continuation of its main use until the 35th or 34th centuries cal BC, the results presented here offer the opportunity to discuss agency from a more historical perspective. We can now begin to rethink the situation preceding the construction of the enclosure, the circumstances surrounding building and especially the timescales over which it happened, and the frequency and intensity of deposition in the ditches once the arenas of the enclosure had been established. Whittle and Pollard (1999; cf. J. Pollard 2004) have already proposed spatial variation in the character of deposits across the three circuits; now we can add temporal dimensions. We will consider the local area as a whole after presenting Knap Hill and Rybury. Here we will concentrate on first implications for Windmill Hill itself.

It has been commonplace, and quite reasonable, to think of a pre-enclosure phase at Windmill Hill since the 1950s excavations revealed occupation under the outer bank, reinforced by the further findings of the 1988 excavation. We should also note the pits in the area of the inner ditch (I. Smith 1965a, 22–4, fig. 7; Whittle *et al*. 1999, fig. 14), eight of which are cut by ID IX (J. Pollard 1999a, 65). This has given some sense of time-depth for the occupation of the hill as a whole and the possibility of pushing this back to what Whittle (1993) defined as Phase A of the local Neolithic, and for arguing (e.g. Whittle and Pollard 1999, 383) that the hill in particular had already been special or sacred before its further elaboration or consecration through enclosure construction. But now, following our main model, and its probable order of construction from inner to outer to middle circuit, there are two new possibilities. Either the occupation under the outer bank only preceded the construction of the first circuit by a short interval (*1–30 years at 95% probability*; distribution not shown; or *1–15 years at 68% probability*), or indeed it is not demonstrably earlier than it at all. We still do not know the interval between the pits and ID IX. This more compressed history in turn has implications for how we regard the construction of Windmill Hill in relation to other monuments in the locality as a whole. There may be some grounds now for thinking that Windmill Hill might have been the first major act of monumentality in the area, and we will consider that and its consequences shortly below.

Many others have already considered the labour and time involved in the construction of such an enclosure. Figures of around 100,000 hours of labour (Renfrew 1973b, 547), or, calculated on a different basis, around 63,000 hours (Startin and Bradley 1981), emerged from discussions in the 1970s. The general assumption was that a task such as represented by Windmill Hill could be completed quite quickly, though this was rarely or ever given specific estimates. Our main model changes this, and requires us to think of the span of a lifetime or of two generations (taking a generation as 25 years: see discussion in Whittle *et al*. 2007a) for the construction of the monument as a whole (Figs 3.15 and 3.21). As already discussed with reference to Hambledon Hill (Healy 2004; Mercer 2004; Mercer and Healy 2008), this immediately gives a different perspective on the scale of labour that needed to be mobilised at any one time, and this must apply to Windmill Hill as well. Our suggested order of construction now brings some sense of the rhythm of the social obligations, combinations and fissioning which are likely to have accompanied the undertaking of such a series of enterprises. This cycle starts in what we could think of as a muted way, with the construction of an enclosure at most some 90 m across, with a ditch of relatively modest depth, some of whose segments were quite short and indeed almost pit-like. Then came a gathering crescendo – even perhaps within the same generation – with the mobilisation of labour for the much more ambitious task of building the outer circuit: up to *c.* 360 m across, sprawling partway down the north slope of the hill, with much longer stretches of ditch, accompanied by substantial earthwork banks and potentially even timbering, and the ditch itself both deeper and wider than achieved in the inner circuit (McOmish 1999, 14). This was the apogee of ambition, reinforced by other activity not far away at West Kennet (see below). Then came a less massive but still impressive last addition, following still quite quickly on, with the middle circuit up to *c.* 220 m across, but slighter in construction, pit-like segments again accompanying longer stretches of ditch, with some segments, such as that seen in Trench D in 1988, once again of quite modest depth, and with indications only of a slight accompanying bank. Whatever its scale, it served further to elaborate the division of space on the hill. We could suggest, for the middle circuit, a deliberate echo of the style of the inner circuit in general, including the replication of an alternation between longer and shorter segments, in contrast to the generally extended ones of the outer ditch (Fig. 3.2; Whittle *et al*. 1999, fig. 14). At the probable timescale now suggested, it is not implausible to invoke some continuity of participation of the different constituent groups who contributed to these enterprises.

This new temporal perspective thus serves to break down the labour requirements necessary for the construction of Windmill Hill at any one point in its development. But at the same time, it requires us to think of the sociality of construction over a longer timescale than we have been accustomed to consider. If we allow that all enterprises of this kind must have been preceded and accompanied by a chain of discussion, negotiation, argument, tensions and eventual agreement, if only on a temporary basis (C. Richards 2004; 2005), an intense focus on this project was

maintained over a strikingly long timescale in human terms. This is not to claim that the enterprise at the end was the same as the form in which it began, nor, following Chris Evans (1988b) that final layout was necessarily conceived right from the beginning, and the timescale proposed can allow for lulls or periods of exhaustion. But we can suggest that given people stayed through their lives with an undertaking which began when they were young, or that the efforts of one generation inspired or provoked their immediate successors to continuation and perhaps some sense of completion. There was, perhaps, a natural rhythm here of beginning, enlargement and infilling. Once the massive scale of the outer circuit had been achieved, any further enlargement outwards would have required a colossal undertaking; the circumference of the Avebury henge itself is little bigger, and though larger circuits are known – locally at Crofton, as briefly discussed in the introduction to this chapter – they may not have been thinkable at this time.

In proposing spatial variation in the character of deposits across the three circuits, Whittle and Pollard (1999, 387, fig. 227) suggested that the inner and middle circuits were the locus for the presentation of deposits and material to do with the domestic sphere, in contrast to the outer circuit where there was more emphasis on articulated bone and human deposits, and despite some impressive individual deposits, probably lower densities of material in general. The simplicity of these distinctions has already been criticised by Joshua Pollard himself (J. Pollard 2004). The main model presented here serves further to subvert the spatial scheme first suggested but does not necessarily do away with it altogether. Once again we can now think with greater precision of the temporal dimension, in two ways.

The first deposits in the segments of the inner ditch were varied in character, but recurrently involved quite concentrated bone groups and spreads, with other accompanying material. Both bones and other material may have been processed or even curated to some degree, and bone groups themselves consisted of the remains of different species and different skeletal parts, with very rare complete animals (Whittle *et al*. 1999; Grigson 1999). Such deposits appear to have been abundant. Could they have been principally the residues of meals or feasts associated with initial construction? They should still have been visible, to varying extents, as the outer ditch was being constructed. The outer ditch from this perspective thus does not need to be rigidly separated from the character and connotations of the inner circuit; it might be seen in varying senses as to encompass, celebrate, commemorate and protect it. While only the outer and inner circuits were in existence, there would have been a visible play between the still continuing deposits in the inner ditch and those now beginning to be placed in the outer. There need not have been a rigid distinction; bone deposit 229 within the basal chalk fill of the outer ditch in Trench B, for example, would not be out of place in the inner circuit. And when the middle circuit had been established, there would have been a reinforcement and commemoration of the themes and concerns established from the beginning in the deposits in the inner ditch.

As Isobel Smith suggested (1965a, 14), our modelling confirms that all three circuits remained open at the same time, for a long period. Can we use the results of our main model to visualise the frequency and visibility of deposition through this longer history? First, we can now state that deposition in the main use of the enclosure took place over a period of around 350 years (Fig. 3.16: *use Windmill Hill*). While numerous animals may have been consumed during this history and numerous artefacts deposited, this timescale must serve to reduce our sense of the intensity of activity at any one time. We consider an attempt to quantify this issue further in Chapter 14.2. Secondly, if we think of the natural process of silting, the clock started ticking in each circuit at a different time, and it may also have been reset by cleaning or recutting in different segments at different intervals.

So we may now be able to make some quantifiable contrast between the intensity of activity, involving above all the mobilisation of interest, agreement and then labour, surrounding the circumstances which brought the enclosure into existence, and the intensity of subsequent gathering, feasting, curation of remains, and final deposition. We do not need to emphasise the early history of the enclosure too much, but its memory must have something to do, in this instance, with people choosing to come back at intervals, again and again, for continued use of the place.

Both Smith and Whittle attached considerable significance to the stratigraphy of Outer Ditch V/Trench B because it provided the fullest version of a sequence essentially common to all the segments, the only one in which the upper layers were not conflated. The results presented above show that the segment's stratigraphic clock was set almost to zero half a millennium after construction. The sequence is thus atypical of an enclosure in which natural silting was the norm and recutting rare. Smith herself recognised the possibility of a recut, not by reinterpreting the OD V stratigraphy but by analogy with retrospectively recognised recuts at the outer edges of some of the Hembury sections: 'Sherds of an Ebbsfleet bowl, five to six feet deep in the outer ditch at Windmill Hill, can now also be seen to have been introduced during (previously unrecognised) disturbance of the outer part of the ditch' (1971, 98). The OD V sequence can thus no longer be used to demonstrate that Ebbsfleet Ware was in use at Windmill Hill before the more elaborate substyles of Peterborough Ware, especially as an articulating sample from bone deposit 227, the context of the Ebbsfleet sherd found in 1988, is dated to 2620–2460 cal BC (95% confidence; Table 3.2: OxA-13500). The occurrence of Ebbsfleet Ware in lower spits than Mortlake Ware in three of the segments excavated by Keiller (Hamilton 1999a, 305) may have been a product of Keiller's spit-based recording system, especially as the apparent sequence is reversed in a third. The chronology of the substyles of Peterborough Ware (cf. Gibson and Kinnes 1997) will be clarified by the ongoing

Bayesian analyses of Peter Marshall and colleagues (P. Marshall *et al.* forthcoming).

This exceptional (as far as we know) recut segment coincides with modifications to the bank. An apparent entrance in the outer bank corresponding to the causeway between Outer Ditch V and the next segment to the north is crossed by a vestigial bank and on either side of another apparent entrance corresponding to the causeway between Outer Ditch V and the segment to the south, the bank terminals are sharply truncated (McOmish 1999, 14, fig. 15: A). In this second case, the sharpness of the truncation suggests a fairly recent date. There are, however, indications that the entrance to the north might have been made at much the same time as the ditch was recut. It is opposed to a relatively wide causeway between Middle Ditch I and II, on one side of which, in Middle Ditch I, was one of the largest concentrations of Peterborough Ware on the site; there was also something of a concentration of Peterborough Ware in Inner Ditch V and VII, opposite to Middle Ditch I (Zienkiewicz and Hamilton 1999, fig. 196). If pottery was deposited by those passing in or out of the enclosure, as the concentration of Neolithic Bowl in Inner Ditch VII on one side of the indented north-west entrance suggests (I. Smith 1965a, 5), then the bank modification and the Peterborough Ware together could reflect the creation and use of a new approach to the enclosure, one oriented to the increasingly frequented south-facing slope of the hill and to the Kennet valley where new monuments were beginning to be built. It may be no coincidence that the undated square enclosure is sited opposite this proposed new entrance and that its west entrance faces towards it (Whittle *et al*. 1999, fig. 14).

An originally continuous bank north of Outer Ditch V also prompts an alternative interpretation of the row of postholes under the outer bank extending for at least 17 m (Whittle *et al*. 1999, figs 67, 220). If the outer bank was originally continuous, features found beyond its terminal in Outer Ditch VI (I. Smith 1965a, fig. 8) could originally have been beneath it. If all the postholes in the row were within the area covered by the bank then they could have formed an internal framework or an external revetment. This case is strengthened by the coincidence of their line with the division between the clearly bedded outer part of the bank and the less differentiated inner part (Whittle *et al*. 1999, fig. 71).

3.2 Knap Hill, Alton, Kennet, Wiltshire, SU 1210 6365

Location and topography

Knap Hill lies at 255 m OD, on a steep spur of Middle Chalk, capped with Clay-with-Flints and projecting south into the Vale of Pewsey (Fig. 3.1). Like Rybury, it is a striking landform when viewed from the south, although the actual enclosure faces towards the higher downs to the north, with which it is intervisible (Oswald *et al*. 2001, figs 2.6, 4.13, 5.25, 5.29). The enclosure has an area of 2.4 ha and consists of a single circuit of sub-triangular plan, conforming to the contours of the hill and possibly incomplete on the steepest, southern side (Fig. 3.22; Oswald *et al*. 2001, fig. 2.7). Exceptionally compared to the situation at other enclosures, causeways seem here to correspond precisely to gaps in the bank (Oswald *et al*. 2001, 43, fig. 5.29).

There was late Mesolithic activity on Golden Ball Hill immediately to the north-east (Holgate 1988a, 213, 222; Anon. 1997; 1999). Material of early Neolithic date has been collected from the vicinity (Oswald *et al*. 2001, 130), and the chambered long barrow known as Adam's Grave lies on an adjacent spur some 500 m to the south-west (J. Pollard 2005, fig. 10.1). In the Early Bronze Age round barrows were built within and around the earthworks (Oswald *et al*. 2001, figs 2.7, 5.29), forming part of a longer east-west alignment above the Vale (Cleal 2005, fig. 11.1).

History of investigation

The well preserved earthworks were recognised from at least the seventeenth century (Oswald *et al*. 2001, caption to fig 2.6). Two of the round barrows were opened in the 1850s by John Thurnam, who found a central circular pit, *c.* 0.60 m deep in the chalk and 0.60 m across, nearly full of burnt bones and ashes but without artefacts beneath a barrow within the enclosures, and no burial in one outside it (Thurnam 1860, 326–7). Excavations by M.E. and B.H. Cunnington in 1908–9 led to the recognition of 'a method of defence hitherto unobserved in prehistoric fortifications in Britain . . . the entrenchment, instead of being continuous. . . is broken up into short and irregular sections . . . It is believed that the camp is of early date, that it belongs to the bronze, or even to the late neolithic period' (Cunnington 1909). The Cunningtons recorded deposits of a kind which subsequently became familiar from other enclosures. 'The majority of the finds were in groups within a foot or so of the bottom of the ditch. At one spot seventy-two flint chips were found (6ft. deep) all within the space of a foot or so' (Cunnington 1909). This concentration of finds in the lower fills to some extent corroborates the evidence of the two schematic published sections which suggest natural silting without recutting or other intervention (Cunnington 1912, 45, 59). The Cunningtons also showed that the north-east of the 'old camp' was cut by a 'plateau enclosure' of Romano-British date; that two pits outside the enclosure in the same area contained pottery and other artefacts like those from the ditches of the 'old camp'; that a long mound which overlay both these pits and the circuit of the 'old camp' was of Romano-British or later date; that there was further activity on the hill in the early Saxon period and in the seventeenth century; and that a small mound outside the circuit to the north covered an incomplete but articulated burial (Cunnington 1912).

Half a century later, in 1961, four trenches were excavated by Graham Connah, as part of an independent research programme, across the north-west side of the

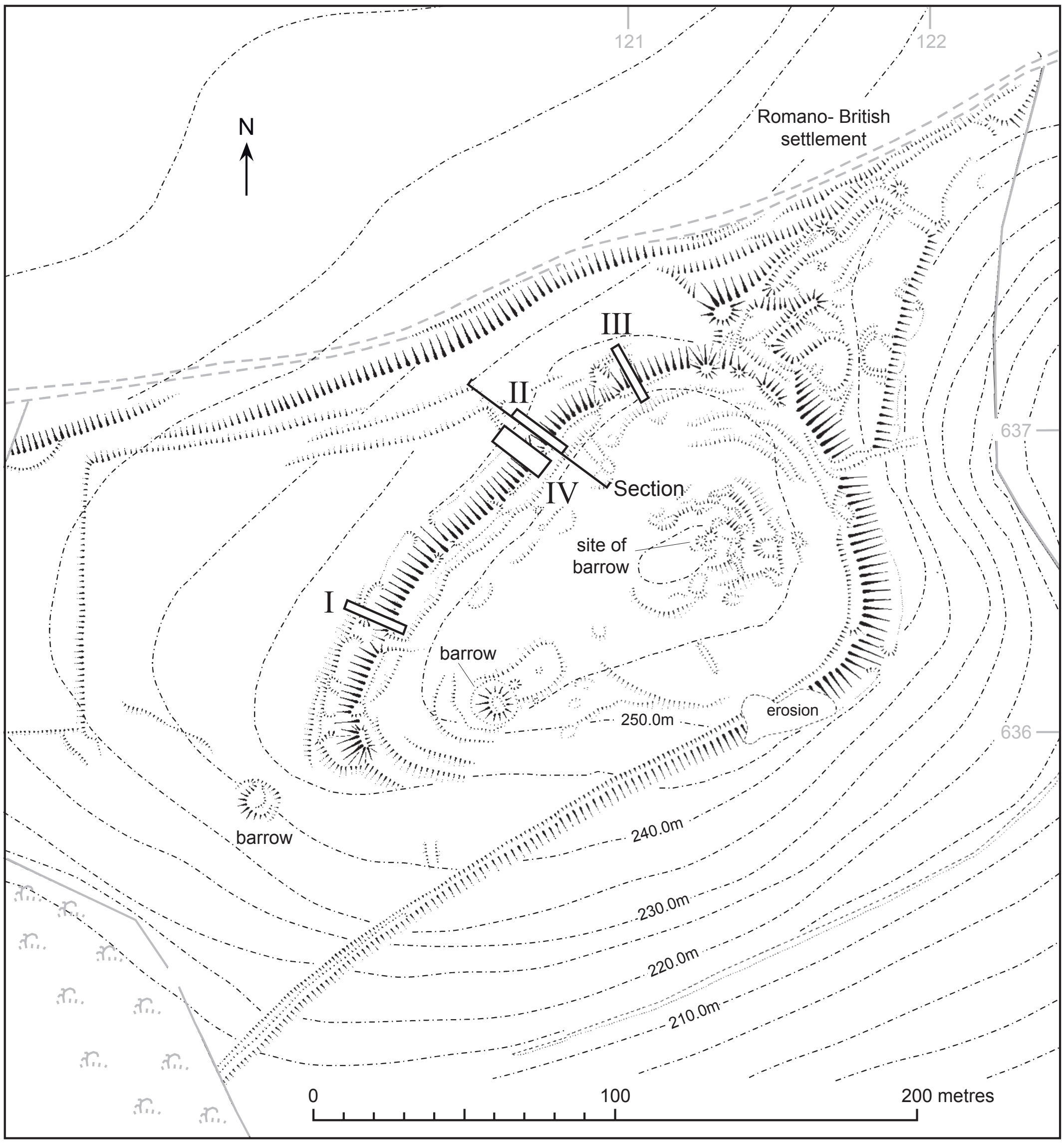


Fig. 3.22. Knap Hill. Plan showing location of Connah's 1961 trenches. The more extensive earlier excavations by the Cunningtons are imprecisely located. After Connah (1965, fig. 1) and Oswald et al. *(2001, fig. 2.7).*

enclosure, three (I, II and III) sectioning the bank and ditch, one (IV) located on a causeway, the exercise being designed 'to re-examine this site in the context of modern archaeological research' (Connah 1965, 1, fig. 1). Pottery was scarce in the ditches, as was animal bone, despite its prevalence beneath the bank (Connah 1965, tables I and II). A knapping cluster on the surface of the primary chalk rubble in cutting I (Connah 1965, fig. 2, table I) replicated the Cunningtons' discovery of several clusters of 'flint chips'. Connah's careful stratigraphic observation and naturalistic sections make it clear that the ditches, once dug, were left to silt naturally (1965, 3–7, 10, figs 2–4; Fig 3.23). There was no artefactual evidence for activity on the site between the building of the enclosure and the accumulation of stylistically late Beaker sherds in the upper levels of the ditch (Connah 1965, figs 3, 6). The record of later periods was expanded by the discovery of a Romano-British inhumation cut into the top of the silted ditch (Connah 1965, 7).

Previous dating

Two radiocarbon dates were obtained by Connah following his 1961 excavations (Table 3.3: BM-205, -208; Connah 1969). These were prepared (Barker and Mackey 1960; H. Barker *et al*. 1971), combusted (H. Barker *et al*. 1969a), and converted to benzene (Noakes *et al*. 1965). They were measured by LSC (H. Barker *et al*. 1969b). They bracket the infilling of the ditch, the sample for BM-205 coming from near the base and that for BM-208 from the topmost fill. BM-205 was measured on an antler implement which had arguably been used to dig the ditch and would have been contemporary with that event. Given the pre-treatment used for the dating of this sample, this age is likely to be at least broadly accurate, although its large standard deviation provides a calibrated date range spanning some 600 years at 95% confidence (Table 3.3). BM-208 was measured on an unidentified bulk charcoal sample which may have included material of diverse ages, and can hence provide

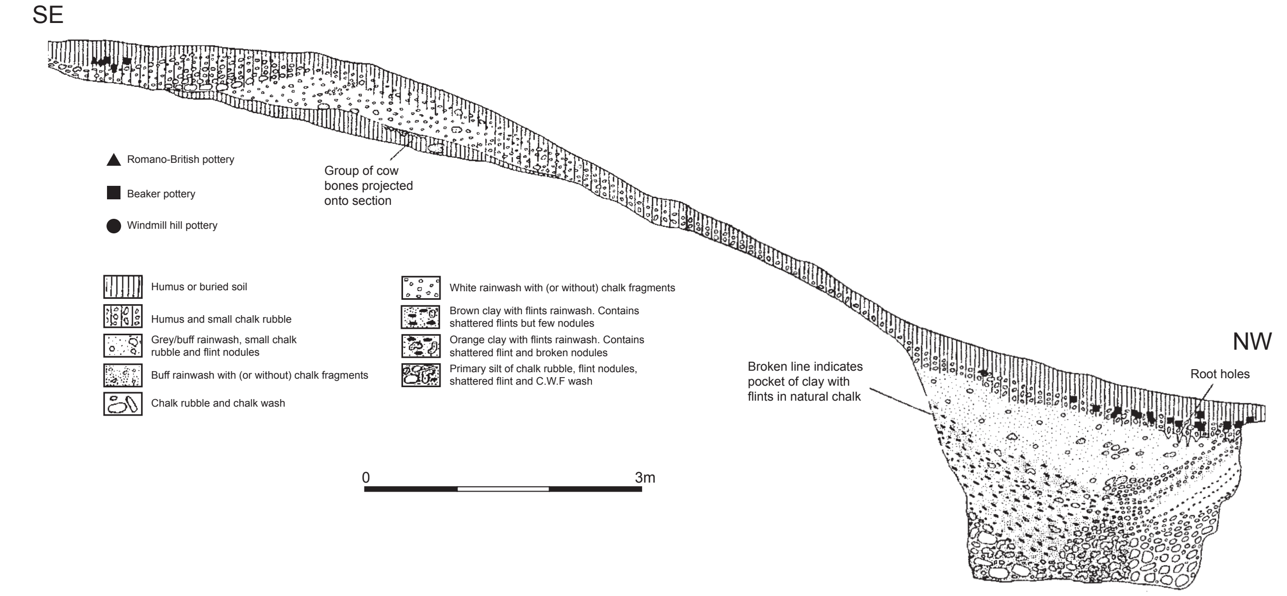


Fig. 3.23. Knap Hill. Section through bank and ditch. The 'group of cow bones projected onto section' is shown in Fig. 3.24 and included the samples for GrA-29809 and OxA-15200. After Connah (1965, fig. 3).

only a *terminus post quem* for its context. Its calibrated age range is even wider than that of BM-205, encompassing almost the currency of Beaker pottery in Britain (Needham 2005, 209–10).

Objectives of the dating programme

In addition to the usual questions of construction date and duration, the proximity of the site to Windmill Hill and to a concentration of long barrows posed the question of its chronological relation to them.

Sampling strategy

Sampling selection was restricted by the uneven survival of the Cunningtons' finds and by the dearth of stratigraphic information attaching to them, as well as by the limited extent of Connah's excavation. It was, on the other hand, greatly favoured by the exemplary quality of Connah's archive and by the fact that he sectioned the well preserved bank (Fig. 3.23) at three points, encountering articulated animal bone at each. The only contexts offering suitable samples were the buried soil beneath the bank and the primary fills of the ditch.

Results

Six further radiocarbon measurements were obtained, including a new replicate measurement on the antler used for BM-205, for which enough of the original sample survived, and two measurements on an articulated partial cattle foot (Fig. 3.24; Connah 1965, pl. IIa). The two measurements on this cattle foot are statistically consistent (Table 3.3: OxA-15200 and GrA-29809; T'=1.1; T'(5%)=3.8; ν=1). The two measurements on the antler, however, are not statistically consistent (Table 3.3: BM-205 and GrA-29808; T'=4.6; T'(5%)=3.8; ν=1).

Full details of all the results from Knap Hill are provided in Table 3.3.

Interpretation

Three bones, each from an articulated group, were dated from the buried soil underneath the bank (GrA-29810, OxA-15199, K/11/(8)). Assuming that the bank was constructed from upcast or spoil from the ditch, these fresh bones must predate the digging of the ditch. The earliest sample recovered from the primary fills is the antler from cutting I (BM-205 and GrA-29808). Later than this may be the sherd with fresh residue from the top of the primary chalk rubble in cutting III (OxA-15305). On stratigraphic grounds, BM-208, associated with Beaker pottery in the topmost fill of the ditch in cutting II, should be later than these samples, although the bulk and unidentified nature of this sample makes this measurement of limited value.

A model which incorporates this interpretation of the archaeological sequence with the radiocarbon dates has poor overall agreement ($A_{overall}$=2.3%). It appears that GrA-29808 is too early for its stratigraphic position. Either this measurement is an extreme outlier, or the antler in question is residual, or the ditch is earlier than the bank. Since there is no archaeological trace of upcast from a primary ditch, this latter interpretation seems unlikely. The model shown in Fig. 3.25 treats GrA-29808 as an outlier, excluding it from the analysis. In fact, because of the large error on BM-205, it makes practically no difference whether this measurement is included in the model.

The model shown in Fig. 3.25 suggests that Knap Hill was constructed in *3620–3585 cal BC* (*4% probability*; Fig. 3.25: *build Knap Hill*) or *3530–3375 cal BC* (*91%*

Table 3.3. Radiocarbon dates from Knap Hill, Wiltshire. Posterior density estimates derive from the model defined in Fig. 3.25.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
BM-205	K/I/6/A.1	Red deer. Antler. Photograph in site album (Devizes Museum Library AA box 14) shows K/I/(6)/A.1 as length of beam with one tine, projecting from section, looking like part of an antler pick	Segment 3, cutting I, layer 6. Primary rubble fill of ditch, near base, sealed by 1–2 m of undisturbed deposits (Connah 1965, fig. 2: south-west face), at 46'4" x 1'4" x 5'4" (finds book)	4710±115		4948±38 T'=4.6; T'(5%)=3.8; ν=1	3710–3100	*3620–3595* (*2%*) or *3520–3370* (*93%*)
GrA-29808	K/I/(6)/A1	Red deer. Antler, fragments remaining from the measurement of BM-205, of which this is a replicate	From same context as BM-205	4975±40	−21.4			
OxA-15199	K/I/(8)/B21	Cattle. Radius from immature individual, with articular ends missing, found with fragmentary fitting ulna	Segment 3, cutting I, layer 8. Under bank. At 21'9" x 1'9" x 1'10". Found together with ulna on old land surface beneath bank of enclosure (Connah 1965, fig. 2). The fact that the two bones were given a single find number and measured-in at a single point indicates that they were found in articulation	4657±31	−22.4		3620–3360	*3625–3595* (*11%*) or *3525–3390* (*84%*)
BM-208	K/II/(4)	Unidentified bulk charcoal sample. 'All the charcoal from that layer was pooled in order to make up a large enough sample' (Connah 1969, 305)	Segment 5, cutting II, layer 4. In topmost fill of ditch, with sherds of long-necked Beaker (Connah 1965, fig. 3)	3790±130			2580–1880	*2580–1875*
OxA-15200	K/II/(8)/B107/A	Cattle. Proximal half of L metacarpal found articulated with 2 carpals (G. Connah). Replicate of GrA-29809	Segment 5, cutting II, layer 8. Found articulated on old land surface under bank. (Connah 1965, fig. 3, pl. IIa), at 22'4" x 3'4" x 2'	4699±37	−20.8	4725±27 T'=1.1; T'(5%)=3.8; ν=1	3640–3370	*3635–3550* (*34%*) or *3540–3490* (*42%*) or *3455–3380* (*19%*)
GrA-29809	K/II/(8)/B107/B	Cattle. Proximal half of L metacarpal found articulated with 2 carpals (G. Connah). Replicate of OxA-15200	From same context as OxA-15200	4755±40	−21.3			
OxA-15305	K/III/(6)/P23	Fresh internal carbonised residue adhering to inner surface of Neolithic Bowl sherd (Connah 1965, 21). Sherd now formed of fragments glued together along recent breaks	Segment 6, cutting III, layer 6. At top of primary chalk rubble (Connah 1965, fig. 4) At 49'8" x 1'4" x 3' 6"	4701±34	−27.7		3640–3370	*3615–3595* (*2%*) or *3525–3485* (*9%*) or *3475–3365* (*84%*)
GrA-29810	K/III/(8)/B18	Cattle. R radius of mature individual found with fitting ulna	Segment 6, cutting III, layer 8. Under bank. 'Lying right on top of (8)' (findsbook). Found together with ulna on old land surface beneath bank of enclosure (Connah 1965, fig. 2), at 20' 10" x 7'0" x 2'1". The fact that the two bones were given a single find number and measured-in at a single point indicates that they were found in articulation	4775±40	−22.5		3650-3380	*3640–3495* (*79%*) or *3435–3385* (*16%*)

Fig. 3.24. Knap Hill. The articulated bone group including the samples for GrA-29809 and OxA-15200 beneath the bank in cutting II. © Wiltshire Heritage Museum.

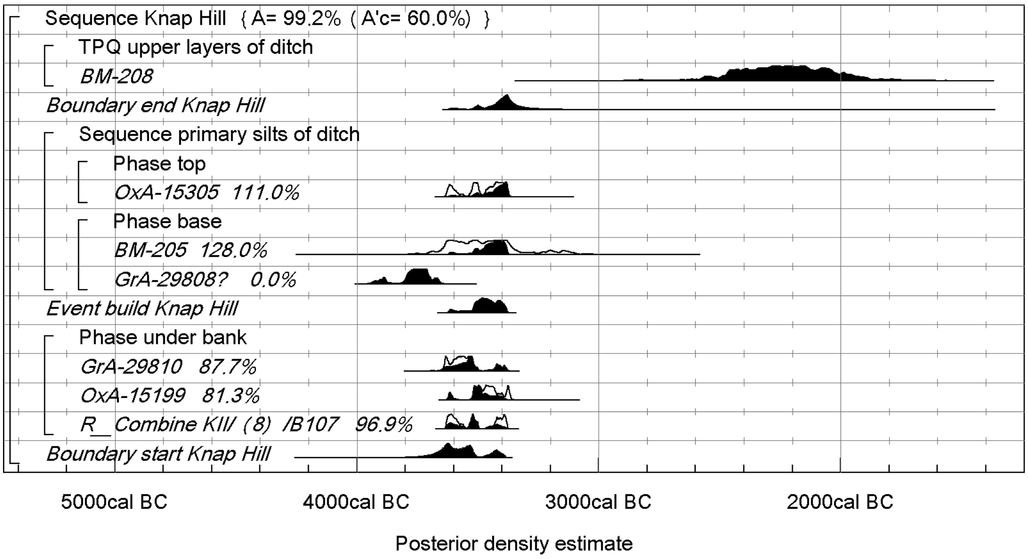


Fig. 3.25. Knap Hill. Probability distributions of dates. The format is the same as for Fig. 3.5. The large square brackets down the left-hand side, along with the OxCal keywords, define the overall model exactly.

probability), probably in the 35th century cal BC (*3510–3435 cal BC* (*53% probability*) or *3425–3400 cal BC* (*15 % probability*). On the basis of the limited number of measurements available, the primary fill of the Knap Hill ditch may have accumulated by *3620–3575 cal BC* (*3% probability*; Fig. 3.25: *end Knap Hill*) or *3525–3220 cal BC* (*92% probability*), probably by *3505–3495 cal BC* (*2% probability*) or *3445–3330 cal BC* (*66% probability*). It is unclear, however, for how long activity continued at this enclosure. This was for *1–460 years* (*95% probability*; Fig. 3.26: *use Knap Hill*), more probably either for *1–65 years* (*23% probability*) or *115–280 years* (*45% probability*).

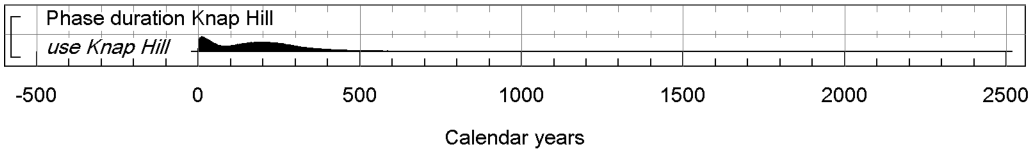


Fig. 3.26. Knap Hill. Probability distributions of the number of years during which the primary silts accumulated (derived from the model defined in Fig. 3.25).

It can be seen that the posterior density estimate for the use of Knap Hill is strongly bimodal. On the basis that the ditch was left to infill naturally and there is no sign of recutting, and because there is a scarcity of sherds and bones, we believe that a short duration, probably of well under a century and perhaps only a generation or two, is more plausible.

3.3 Rybury, All Cannings, Kennet, Wiltshire, SU 0832 6397

Location and topography

The Rybury enclosure lies at 235 m OD, on a steep spur of Middle Chalk projecting south into the Vale of Pewsey (Fig. 3.1), viewed from which it is a striking landform. The enclosure is actually tilted towards the higher downs to the north, with which it is intervisible (Oswald *et al*. 2001, figs 5.25, 5.27–8). It has an approximate area of 2 ha and is obscured by an Iron Age hillfort, beyond which the eastern part of the circuit extends as a well preserved earthwork, with an apparently continuous bank and a segmented ditch (Fig. 3.27). It seems to consist of a single circuit encircling the summit of the spur except to the north where it dips down the slope. A continuous crescentic bank with a clearly causewayed ditch some 150 m to the south on a knoll on the tip of the spur may well be contemporary (Curwen 1930, 38–40; Oswald *et al*. 2001, figs 4.13, 8.7).

History of investigation

Rybury was recognised as a possible causewayed enclosure by Curwen (1930, 38–40). It remains unexcavated save for a single trench cut by Desmond Bonney in 1963. The ditch 'was flat-bottomed and 7 ft. [2 m] deep at the outer face. . . .Waste flint flakes were found in abundance throughout the filling, over 600 all told, but no worked implements. A few teeth and scraps of bone were also found' (Bonney 1964). The teeth and bone could not be found in the Wiltshire Heritage Museum in 2005, so that no radiocarbon measurements could be made. What could be found, however, were sherds from a single decorated Neolithic Bowl which had eroded from above the inner edge of the southern arc of the hillfort ditch (I. Smith 1965b). The sherds are weathered, but the fact that they come from a single vessel suggests that their original context is unlikely to have been far from the findspot. They reinforce the case for a causewayed enclosure on the hill.

3.4 Discussion

The relationship of causewayed enclosures and long barrows: the history of local monumentality

The exceptional concentration of long barrows in the area (Fig. 3.1; Whittle *et al*. 1999, fig. 7; J. Pollard 2005, fig. 10.1) has long invited interpretations which link their use to that of the nearby causewayed enclosures. Some have been specific, such as Isobel Smith's suggestion that disarticulated human bone in the ditches of Windmill Hill may have been taken from the four chambered long barrows in the vicinity (1965a, 137). Others have been more general, such as Colin Renfrew's hierarchical model in which each causewayed enclosure in Wessex served as an aggregation site for an emerging chiefdom, and the nearby long barrows marked the territories of component communities, a minority of whom were buried in them (1973). The validity of such views depends on the chronology of the barrows in relation to the enclosures. This can be assessed to a certain extent for the present area, since the West Kennet long barrow has been the subject of a major dating programme (Bayliss *et al*. 2007b), belonging now also to the 37th century cal BC, and some dates, of varying quality, are available from five other long barrows in the area.

First, we can consider the relative sequence of the precisely dated sites of Windmill Hill and the West Kennet long barrow (Fig. 3.28). The small quantity of Bowl pottery from the barrow is comparable with the Windmill Hill assemblage in including neutral forms, some decoration and some relatively heavy rims (Piggott 1962, fig. 10). It is clear that both the inner and outer circuits at Windmill Hill had been constructed by the time that human remains were placed in the chambers of the West Kennet long barrow (*90.3%* and *72.2% probable* respectively). It is probable, however, that the terminal chambered monument at West Kennet had been constructed by the time the middle circuit at Windmill Hill was built (*83.3% probable*). At this time, perhaps in the 3630s or 3620s cal BC, burial in the West Kennet chambers also ceased. These two events are so close in time that it is not possible to determine their relative order, although the people whose remains were deposited in the West Kennet long barrow may have been alive at the time that the community chose to construct the middle circuit of Windmill Hill. They had surely experienced the inner and outer circuits, and the older individuals among them may have participated in the digging of these earthworks (Whittle *et al.* 2008).

This sequence was not predetermined. It cannot be explained any longer by reference to a notion of an

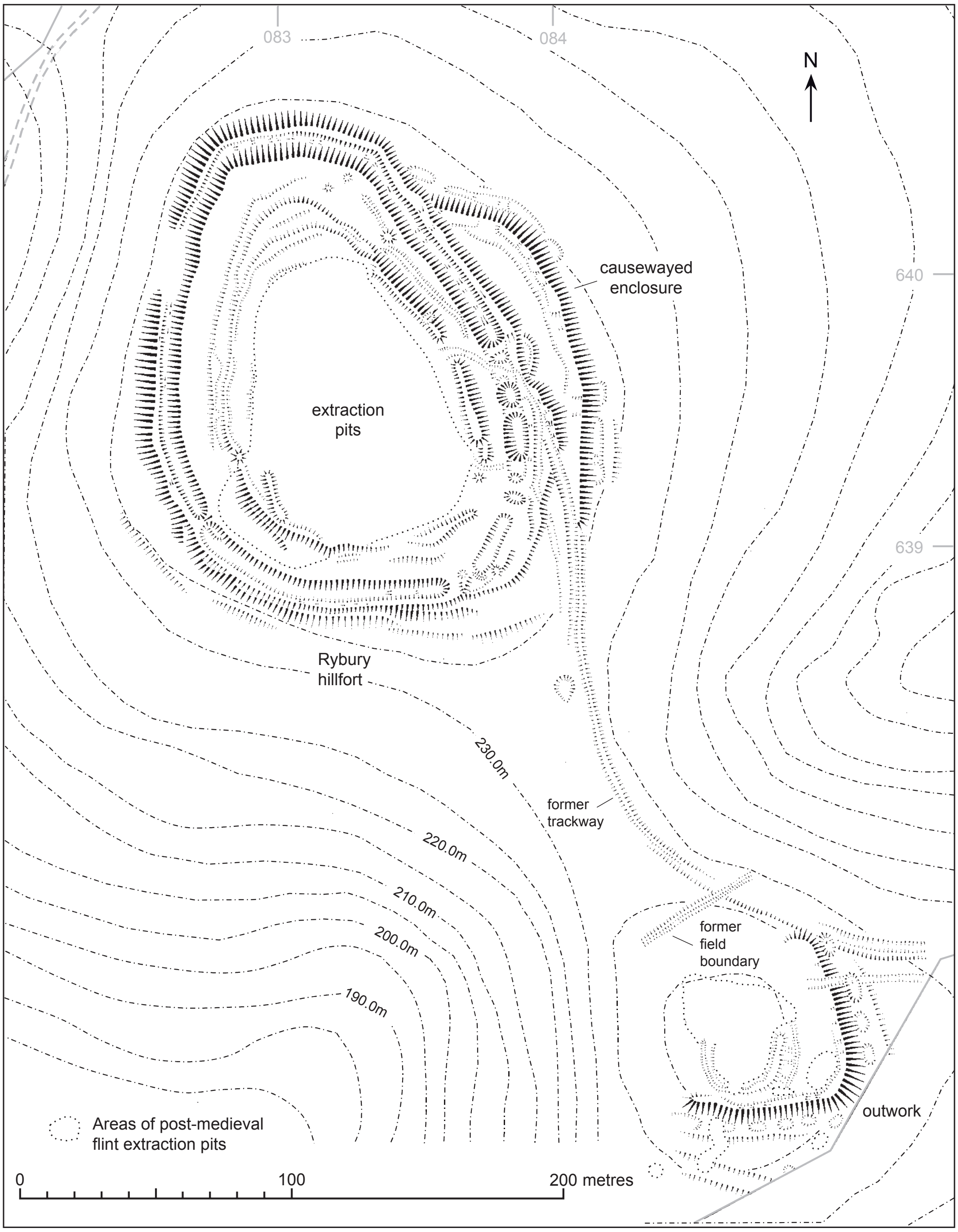


Fig. 3.27. Rybury. Plan. The causewayed enclosure is largely overlain by the Iron Age hillfort, the interior of which is obscured by recent flint-digging pits. The spurwork to the south-east remains undated, although its causewayed ditch suggests that it is contemporary with the enclosure. After Oswald et al. *(2001, fig. 8.7).*

all-inclusive cultural package or repertoire, in which all features of the earlier part of the Neolithic were present and contemporaneous throughout. The sequence could also have been different. In other areas it may have been, as we shall see in other chapters. The emergent, more precise, chronology is therefore of vital importance for the insights it offers into a history of human agency and interaction. We continue to discuss this throughout this volume.

Turning now to the less precisely dated monuments in the area, we have seen above that the enclosure at Knap Hill was constructed probably rather more than a century later than both Windmill Hill and the West Kennet long barrow, probably in the 35th century cal BC. Windmill Hill was still in active use at this time, although the deposition of human remains in the West Kennet long barrow was already several generations in the past. The available radiocarbon measurements from the other five dated long barrows on the North Wiltshire Downs are much more limited in number and quality, some having been measured in the pioneering days of radiocarbon dating. To counteract the scatter on these dates, they have been placed in a single phase of activity (West Kennet is not included in this model, because

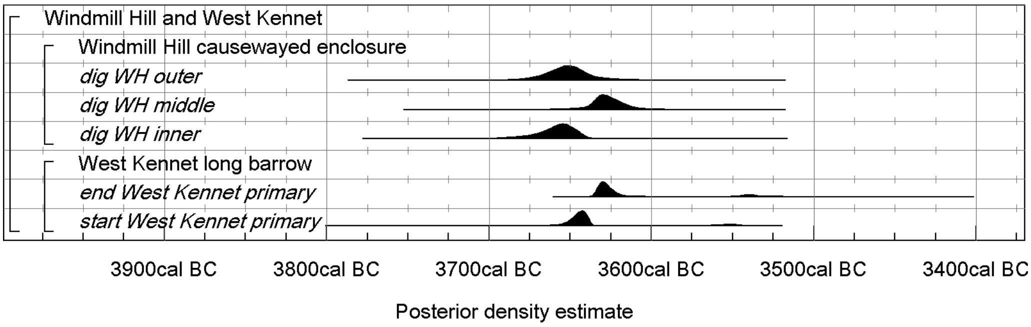


Fig. 3.28. Posterior density estimates for the dates when the circuits were constructed at Windmill Hill (from the model defined in Figs 3.8–11), and when human remains were placed in the chambers of the West Kennet long barrow (from the model defined in Bayliss et al. *2007b, figs 6 and 7).*

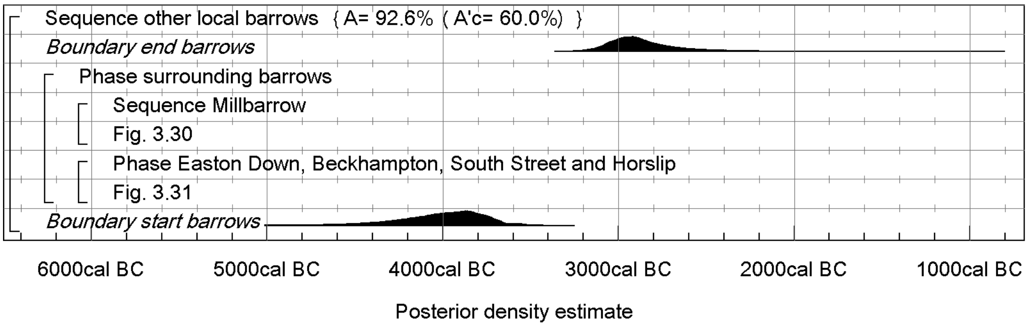


Fig. 3.29. Overall structure of the chronological model for other long barrows on the North Wiltshire Downs. The component sections of this model are shown in detail in Figs 3.30 and 3.31. The format is identical to that of Fig. 3.5. The large square brackets down the left-hand side of Figs 3.29−31, along with the OxCal keywords, define the overall model exactly.

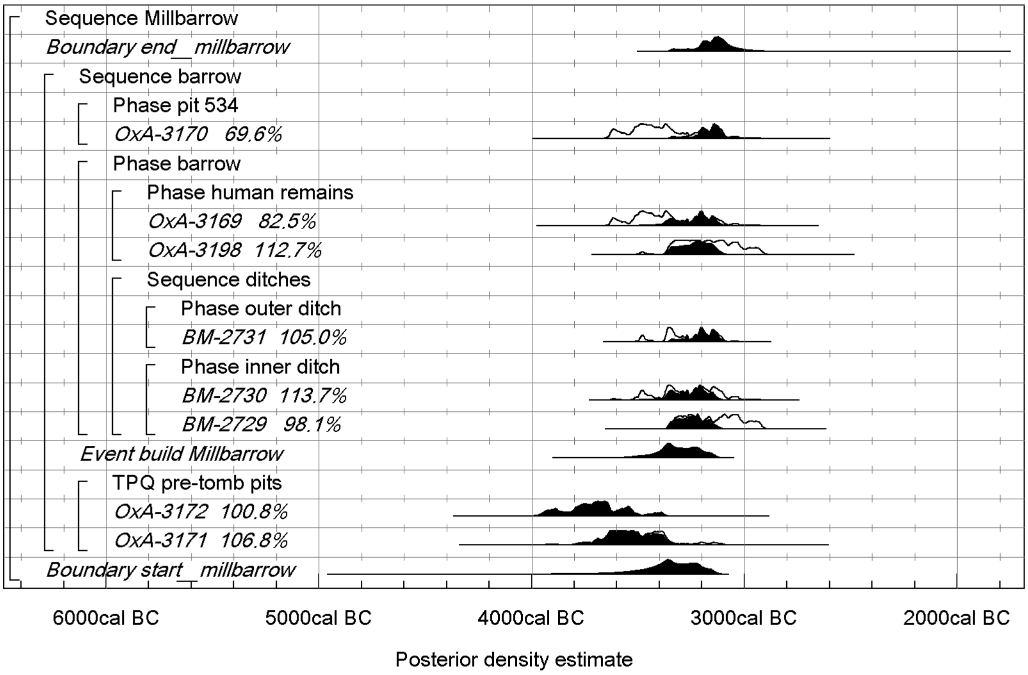


Fig. 3.30. Probability distributions of dates from Millbarrow. The format is identical to that of Fig. 3.5. The overall structure and other components of this model are shown in Fig. 3.29.

it has so many more measurements than the others that it would severely bias the sample). The overall structure of this model is given in Fig. 3.29, with the component section relating to Millbarrow in Fig. 3.30, and the component sections relating to the other four sites in Fig. 3.31.

The double flanking ditches of Millbarrow are most readily seen as resulting from initial construction, entailing the excavation of the massive inner ditches, followed by a re-working, represented by the excavation of the slighter outer ditches. This interpretation is incorporated in the

model (Fig. 3.30). *Termini post quos* for the construction of the mound are provided by OxA-3171–2, measured on disarticulated human bone fragments from pits which would have underlain the mound. An antler fragment from near the base of one inner ditch was dated by BM-2730, and an antler crown from slightly higher in the other by BM-2729. A further antler crown from near the base of an outer ditch is dated by BM-2731. Further disarticulated human remains from the chamber area are dated by OxA-3169 and OxA-3198, and an antler fragment from a pit slightly to the east of the monument by OxA-3170 (Whittle 1994, 4–26, figs 3–7). Of these, the antler fragments and crowns may possibly, although not certainly, have been used to build various elements of the monument. The samples dated at the British Museum were prepared and measured by LSC as outlined in Ambers and Bowman (1998). The samples dated at Oxford were processed as described by Law and Hedges (1989), and dated by AMS (Bronk Ramsey and Hedges 1989). The barrow must have been built after the latest material was placed in the pits beneath the mound and before the deposition of material in the monument itself. This suggests that the mound was raised in *3500–3135 cal BC* (*95% probability*; Fig. 3.30: *build Millbarrow*), probably in *3390–3200 cal BC* (*68% probability*).

The single determination from Horslip long barrow, on the south slope of Windmill Hill (BM-180), was measured on an antler pick from the base of the butt of the east ditch. Its location is consistent with its having been used to build the monument. The fact, however, that its beam end had been subject to groove-and-splinter working could suggest that it had ceased to be used as a pick before it was deposited and could already have been of some age (Ashbee *et al*. 1979, 214, fig. 4, pl. 30b). In the laboratory the sample was decalcified in cold acid and then repeatedly rinsed in cold water (Barker and Mackey 1961, 39). The resultant protein was combusted and converted to benzene as described by Barker (1953), Barker and Mackey (1959), and Noakes *et al*. (1965), and dated by LSC (H. Barker *et al*. 1969b). It is thus uncertain whether its apparently early date (Fig. 3.31; Table 3.4) is accurate, or whether it results from the dating methods employed, from redeposition, or from both.

At Beckhampton Road, dates were obtained for fragments of oak charcoal at least 3 inches (75 mm) in diameter from one of several coherent charcoal patches burnt *in situ* and covered with soil or turves before the mound was raised (NPL-138). This was dated by GPC of carbon dioxide as described by Callow *et al*. (1963). As this sample may have included mature wood and, alternatively or additionally, the fires in question may have predated the mound by some time (Ashbee *et al*. 1979, 245), it is incorporated into the model as a *terminus post quem* for the construction of the mound. Two measurements were made on one of two antler picks found on the surface beneath the mound (BM-506a and b). These may have been placed there immediately before the mound was built. The samples were measured as described by H. Barker *et al*. (1969b). BM-506a was pretreated with acid only (Barker and Mackey 1961, 39); BM-506b was also pretreated with dilute alkali (H. Barker *et al.* 1971). The two measurements are statistically consistent ($T'=2.7$; $T'(5\%)=3.8$; $\nu=1$), and so BM-506a was not necessarily contaminated by a younger humic component (*contra* H. Barker *et al*. 1971, 174–5). Consequently a weighted mean has been taken before calibration. This provides our estimate for the date of construction of the barrow (Fig. 3.31; Table 3.4).

At South Street, dates were obtained for a bulk sample of oak charcoal from two patches beneath the mound (BM-356), an antler implement from the body of the mound (BM-358b), another from the base of the east end of the north ditch (BM-358a) and articulated cattle vertebrae found beside it (BM-357; Ashbee *et al.* 1979, 264, figs 24–5; H. Barker *et al*. 1971, 171–2). These samples were dated as described by H. Barker *et al*. (1969a–b). The charcoal from beneath the mound may have been of varying ages and may have consisted of mature wood, and so it has been used as a *terminus post quem* for the construction of the barrow. The antler from the body of the mound must have been deposited by the time the ditches were bottomed. Our estimate for the construction of the barrow is *3565–3105 cal BC* (*95% probability*; Fig. 3.31: *build South Street*), probably *3495–3385* (*31% probability*) or *3370–3330 cal BC* (*7% probability*) or *3325–3195 cal BC* (*30% probability*).

At Easton Down, a disarticulated cattle humerus from the turfline buried beneath the mound is dated by OxA-3759. This provides a *terminus post quem* for the raising of the barrow. An antler tine tip from the ditch base, perhaps derived from an implement used in construction, is dated by OxA-3760 and a single deer tooth from higher in the rubble fills is dated by OxA-3762. Finally, a cattle tooth from high in the secondary fills is dated by OxA-3761 (Whittle *et al*. 1993, 203–6). These samples were processed as described by Law and Hedges (1989), and dated by AMS (Bronk and Hedges 1989). The barrow must have been built between the time when the cattle humerus was buried beneath the mound, and the time when the antler tine was deposited in the base of the ditch. This suggests that it was raised in *3600–3360 cal BC* (*95% probability*; Fig. 3.31: *build Easton Down*), probably in *3485–3385 cal BC* (*68% probability*).

The settlement context of these monuments is represented fragmentarily by pits and artefact scatters, some preserved beneath monuments, some surviving beyond them. Possibly early plain, light-rimmed Bowl pottery comes, in small quantities, from beneath the South Street long barrow (Ashbee *et al.* 1979, 269, fig. 30: 1–2), from superficial contexts at the Horslip long barrow (Ashbee *et al.* 1979, 223–4, fig. 8: P1–P8), and perhaps from as yet unpublished pits on Roughridge Hill (Anon. 1965, 132–3; Cleal 2004, 176). Heavier-rimmed, neutral or closed plain Bowls, like many in the Windmill Hill assemblage, came from Cherhill, mentioned above, and from a pit on Waden Hill (N. Thomas 1956). In addition to the West Kennet long barrow, mentioned above, decorated wares similar to those of Windmill Hill were collected from Hackpen

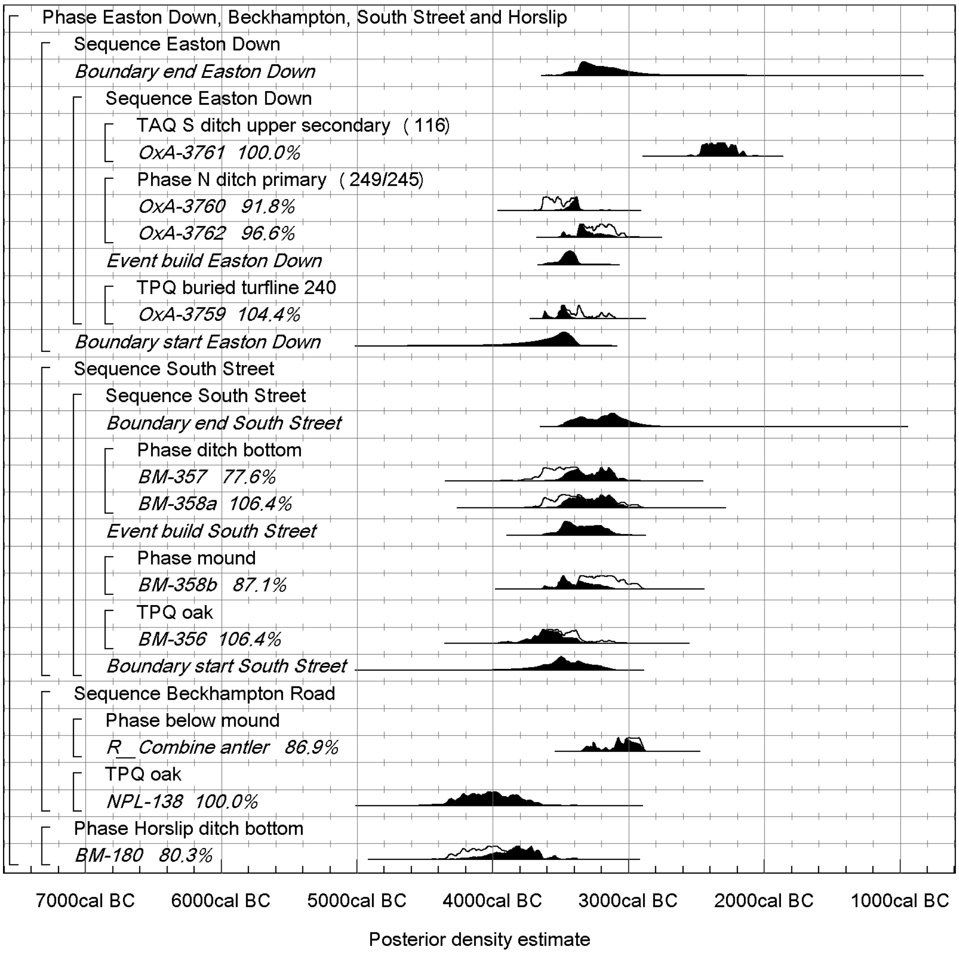


Fig. 3.31. Probability distributions of dates from Easton Down, Beckhampton Road, South Street, and Horslip. The format is identical to that of Fig. 3.5. The overall structure and other components of this model are shown in Fig. 3.29.

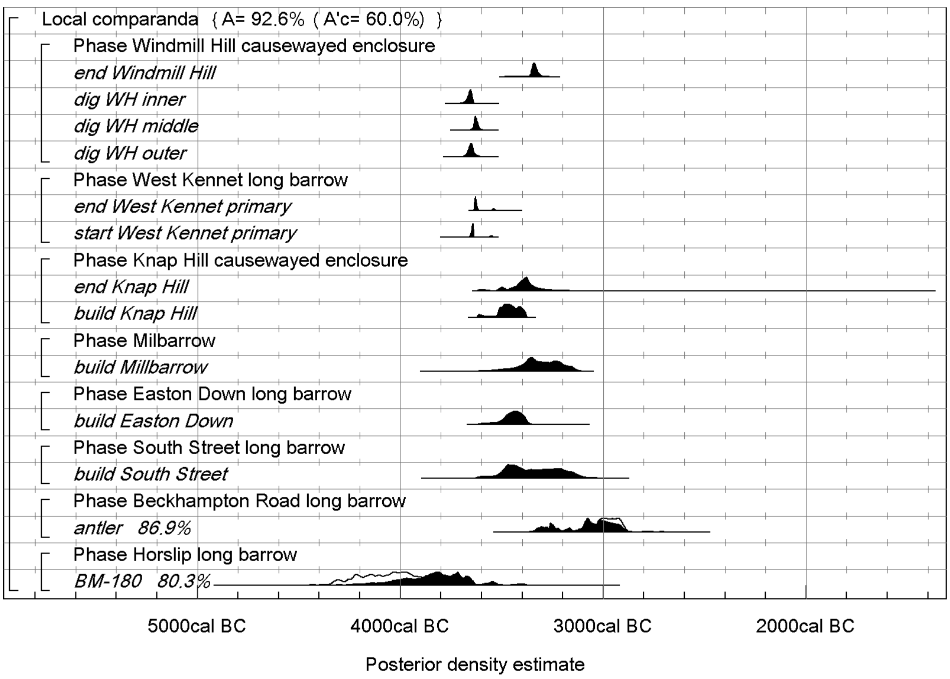


Fig. 3.32. Posterior density estimates of key parameters from dated causewayed enclosures and long barrows on the North Wiltshire Downs. The format is identical to that of Fig. 3.5. The distributions have been taken from models defined in Figs 3.8–11 (Windmill Hill), Bayliss et al. *(2007b, figs 6–7) (West Kennet), Fig. 3.25 (Knap Hill), and Figs 3.29–31 (other long barrows).*

Table 3.4. Radiocarbon dates from the Millbarrow, Easton Down, Beckhampton Road, South Street and Horslip long barrows, Wiltshire, and from other sites in the area. Posterior density estimates derive from the model defined in Figs 3.29–31.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Millbarrow							
OxA-3171	4096	Human. Disarticulated bone fragment	401. Pit among numerous features in area formerly occupied by E (chamber) end of mound, possibly pre-dating it (Whittle 1994, 14–18, figs 8–9)	4750±120	−21.6	3780–3120	*3785–3340*
OxA-3172	6005	Human. Disarticulated bone fragment	548. Pit among numerous features in area formerly occupied by E (chamber) end of mound, possibly pre-dating it (Whittle 1994, 14–18, figs 8–9)	4900±110	−20.9	3960–3370	*3955–3500 (93%)* or *3425–3380 (2%)*
BM-2730	2047	Red deer. Antler fragment	234. Chalk silt and rubble immediately overlying initial silt of inner N ditch, probably at an earlier stage of infilling than 165 (Whittle 1994, 4, fig. 4)	4560±70	−22.2	3520–3020	*3375–3125*
BM-2729	1344	Red deer. Antler crown	165. Earthy material derived from interior, near the top of the primary silts inner S ditch, probably at a later stage of infilling than 234 (Whittle 1994, 5, fig. 3)	4450±60	−22.4	3360–2910	*3355–3135*
BM-2731	1126	Red deer. Antler crown	119. Fine chalky silt near the bottom of outer S ditch (Whittle 1994, 13, fig. 6)	4560±50	−21.9	3500–3090	*3350–3310 (5%)* or *3305–3260 (8%)* or *3250–3100 (82%)*
OxA-3169	4169	Human. Disarticulated bone fragment	N side of supposed chamber area (Whittle 1994, 18–21, figs 2, 8, 10)	4620±90	−21.4	3640–3090	*3405–3105*
OxA-3198	5331	Human. Disarticulated bone fragment	From same context as OxA-3169	4480±80	−21.8	3490–2900	*3360–3115*
OxA-3170	5716	Red deer. Fragment of antler beam with some skull attached	534. Pit beyond E end of barrow (Whittle 1994, 22–3, figs 8, 12)	4630±100	−20.9	3640–3020	*3350–3075 (94%)* or *3065–3045 (1%)*
Easton Down							
OxA-3759	2531	Cattle. Humerus	240. Surface of buried turfline (Whittle *et al*. 1993, 200–3)	4610±60	−21.4	3630–3100	*3635–3575 (20%)* or *3535–3405 (75%)*
OxA-3760	2450	Red deer. Antler tine	249. Ditch base, under primary chalk rubble fill of barrow ditch, trench B (Whittle *et al*. 1993, 205, fig. 5)	4730±65	−21.2	3650–3360	*3535–3340*
OxA-3762	2336	Red deer. Tooth	245/249. Primary fill of barrow ditch, trench B, at a higher level than OxA-3760 (Whittle *et al*. 1993, 205, fig. 5)	4535±65	−21.3	3500–3020	*3495–3420 (10%)* or *3385–3100 (85%)*
OxA-3761	1191	Cattle. Molar	116. Upper secondary fill of barrow ditch, trench A (Whittle *et al*. 1993, 203, fig. 4)	3860±60	−21.6	2480–2130	*2475–2190 (91%)* or *2185–2140 (4%)*
Beckhampton Road							
NPL-138		*Quercus robur*. Charred fragments at least 3 in (75 mm) in diameter	Charcoal patch 15 ft x 4–5 ft (4.5 m x 1–1.5 m), burnt *in situ* or still hot when deposited, forming a continuous layer 2 inches (50 mm) beneath the buried surface and cut by stakes of axial fence of barrow (Ashbee *et al*. 1979, 244–5, figs 15, 16, 21)	5200±160		4360–3650	
BM-506a		Red deer. Antler pick. Replicate of BM-506b. Measured before humic extraction	The lower of 2 antler picks found one above the other on the buried surface (Ashbee *et al*. 1979, 245, fig. 16)	4257±90		3100–2580	
BM-506b		Red deer. Antler pick. Replicate of BM-506a. Measured after humic extraction	From the same context as BM-506a	4467±90		3500–2890	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
South Street							
BM-356		*Quercus* sp. Charcoal	2 charcoal patches on buried soil beneath mound (Ashbee *et al*. 1979, 264, figs 25, 28)	4760±130		3800–3120	*3910–3875* (*1%*) or *3805–3345* (*94%*)
BM-358b		Red deer. Antler fragment	In coombe rock forming part of body of mound in bay II, interpreted as broken and discarded remains of a tool used for quarrying mound material (Ashbee *et al.* 1979, 259, 263, fig. 25)	4530±110		3630–2900	*3630–3575* (*4%*) or *3540–31355* (*91%*)
BM-357		Cattle. 4 articulated cervical vertebrae	On base of E butt of N ditch (Ashbee *et al.* 1979, 264, fig. 24)	4700±135		3760–3020	*3515–3075* (*93%*) or *3070–3025* (*2%*)
BM-358a		Red deer. Antler	From same context as BM-357	4620±140		3660–2910	*3510–3025*
Horslip							
BM-180		Red deer. Antler pick the beam end of which had been subjected to groove-and-splinter working	E butt of E ditch, on base, covered by chalk rubble fill (Ashbee *et al.* 1979, 214, fig. 4, pl. 30b)	5190±150		4350–3650	
Cherhill							
BM-493		Charred *Corylus* timber	Ditch I, context 26. Upper part of initial fill of irregular, sinuous hollow containing a human bone, bones of cattle, caprine, pig, struck flint (including leaf arrowheads), plain Neolithic Bowl pottery (H. Barker *et al*. 1971, 174; Evans and Smith 1983, 52–8, 111–12, fig. 10)	4715±90		3660–3340	
Hemp Knoll							
HAR-2997	HKNEOPT2	Bulk sample of disarticulated animal bone	Pit 1. One of 5 pits beneath an early Bronze Age round barrow (M. Robertson-Mackay 1980, 125–38)	4580±80	−22.6	3630–3020	
West Kennet Avenue occupation site							
HAR-9694		Charcoal (unidentified). Charcoal from this feature was identified as mainly *Corylus* with *Crataegus* and *Prunus.* Charcoal from holes 1–10 is collectively described as almost exclusively twigs and small branches (I. Smith 1965a, 212–14)	Hole 1, cutting VII^{2}R layer 2. Small pit or posthole containing Grooved Ware sherds, a fragment of a group VII axehead and struck flint including a Levallois-like core and a serrated flake (I. Smith 1965a, 214)	5780±80	−27.3	4830– 4450	
Avebury							
HAR-10325		Animal bone	OLS beneath bank in NW quadrant, in area of interface between first and second banks (Pitts and Whittle 1992, fig. 3)	4640±70	−24.8	3640–3110	

Hill before World War II, together with struck flint and animal bone (Piggott 1937), and again recently (Rosamund Cleal, pers. comm.). Other findspots include a superficial context at the Beckhampton Road long barrow (Ashbee *et al.* 1979, 247, fig. 22:1); the site of a round barrow on Overton Hill (I. Smith and Simpson 1966, 151–5, fig. 7: 1–5); the intercutting pit group south of Windmill Hill mentioned above (Whittle *et al.* 2000, fig. 10); and pits beneath an Early Bronze Age round barrow on Hemp Knoll (M. Robertson-Mackay 1980, fig. 4). Early Neolithic lithics occur as a minority component of predominantly later collections from several sites in the area (Holgate 1988a, 233–43).

A *terminus post quem* for one of the Hemp Knoll pits is provided by a date on a bulk animal bone sample (Table 3.4: HAR-2997). A fifth millennium cal BC date for a bulk sample of unidentified charcoal from a posthole of the West Kennet Avenue Occupation Site (Table 3.4: HAR-9694) must reflect the presence of redeposited charcoal or the burning of old wood, given the late Neolithic contents of the feature (I. Smith 1965a, 214) and the third millennium dates of samples from two of the other features on the site (Whittle 1993, table 1). The earliest date for a sample from beneath the bank of the Avebury henge (on an animal bone from the north-west quadrant (Table 3.4: HAR-10325; Pitts and Whittle 1992) may reflect activity in the area in the second half of the fourth millennium cal BC, prior to its construction, also evidenced by plain Bowl and Peterborough Ware sherds from beneath other parts of the bank (I. Smith 1965a, 224–5).

A summary of the chronology of the dated causewayed enclosures and long barrows on the North Wiltshire Downs is given in Fig. 3.32. The uncertainties attendant on the dating of Horslip long barrow aside, and given the limited reliability of some of our estimates for the other long barrows apart from West Kennet, it is apparent that the inner and outer circuits at Windmill Hill were constructed before all the dated long barrows in this area. Only West Kennet (and possibly Horslip) is close in date to the construction of the Windmill Hill enclosure. The other dated monuments, at Knap Hill, Millbarrow, Easton Down, South Street and Beckhampton Road belong to the second half of the fourth millennium cal BC, all but Beckhampton during the main use of Windmill Hill as defined and discussed above.

In this area, on the far from perfect available evidence, the causewayed enclosure at Windmill Hill begins the local sequence of monumentality. Elsewhere in various other parts of southern Britain, long barrows and long cairns, trackways and flint mines may have been the first major constructions. Are the character of the layout and the long duration of activity at Windmill Hill to do with its status as a local founder monument, in the particular setting and context of a region where Neolithic activity was slow to gather pace? The group of long barrows dated locally are surprisingly late; only Horslip, on the basis of a single radiocarbon date from the early years of the technique, may have been constructed before the Windmill Hill enclosure. The range of architectural styles with such later dates is wide, from bayed constructions such as South Street and Beckhampton to the transepted arrangements of West Kennet and Millbarrow. Potentially simple forms, as at Oldbury Hill, King's Play Down, Horton Down or Kitchen Barrow (Pollard and Reynolds 2002), are so far undated, but on the other evidence so far available, are not necessarily to be seen as early simply on the basis of architectural simplicity. (For that reason, they emerge as a significant research priority for the region.) We will come back to this general question in other regions throughout this volume, and again in Chapter 14.3. Is the even later, small and short-lived enclosure of Knap Hill to be seen as in some way subservient to or dependent on the still continuing Windmill Hill enclosure, or can it be seen as an independent construction, looking as much to Pewsey Vale as to the upper Kennet catchment? We will also come back to the character of smaller sites throughout this volume.

Later history

Turning finally to the later history of the area, following the deep recut of the outer circuit at Windmill Hill which contained Ebbsfleet Ware sherds, the small, apparently short-lived Longstones enclosure at Beckhampton appears to date to the first half of the third millennium cal BC, with fresh Grooved Ware at the base of the ditch (Gillings *et al*. 2008, 23–4). The initial, slight earthwork at Avebury was followed by the major ditch and bank construction perhaps in the second quarter of the third millennium cal BC (Pollard and Cleal 2004); the construction or completion of the Outer Stone Circle, however, may have taken rather longer (Pitts and Whittle 1992). Could these events at Windmill Hill, Longstones and Avebury be in some way connected? The West Kennet palisade enclosures are not precisely dated, but can be assigned to the second half of the third millennium cal BC (Whittle 1997b, table 1). It might be to this sort of period that the Crofton enclosure (see above) belongs. The initiation of Silbury Hill has been dated to the 24th–23rd centuries cal BC (Bayliss *et al*. 2007e), though new dates following fieldwork in 2007 are anticipated (James Leary, pers. comm.). A disarticulated cow metacarpal from a pit with a Mortlake bowl towards the north end of the West Kennet Avenue has recently been dated to the turn of the third millennium cal BC (3100–2900 cal BC (95% confidence); NZA-10501; 4378±30 BP; Allen and Davis 2009).

The ditches of Windmill Hill were still slowly infilling in the late third millennium cal BC, and Beaker pottery there could belong to that sort of date or later (Whittle *et al*. 1999). The secondary filling of the chambers and passage of the West Kennet long barrow was probably completed around or soon after *c*. 2400 cal BC (Bayliss *et al*. 2007a). We do not have radiocarbon dates for the West Kennet or Beckhampton Avenues, nor for The Sanctuary (Pollard and Cleal 2004, 125).

Note

1 There is no entirely satisfactory name for this region. Others have used 'the Avebury area' but this perhaps gives too much attention to a later context. 'The Marlborough Downs' have been used for the whole area, but are normally taken to refer to the block of downland north of Marlborough. 'The upper Kennet catchment' is another possibility but research into valley history (J. Evans *et al*. 1993) leaves it open whether the river valley was established as such in the fourth millennium cal BC. We have therefore reverted to an older terminology, following Thurnam (1860), though this in its turn might be seen as a little vague. The problem of terminology will recur through the volume. Local people talk of 'Pewsey Vale' (Rosamund Cleal, pers. comm.).

4 South Wessex

Frances Healy, Alex Bayliss, Alasdair Whittle, Michael J. Allen, Roger Mercer, Mick Rawlings, Niall Sharples and Nicholas Thomas

South Wessex, for our purposes here, can be defined as extending from Salisbury Plain in the north southward to the Dorset Ridgeway.[1] The main landform is Chalk downland, although this is neither uninterrupted nor all of the same character. The four certain causewayed enclosures in this area, however, are all in hilltop locations (Robin Hood's Ball and Whitesheet Hill in Wiltshire; Hambledon Hill and Maiden Castle in Dorset), over an area more than 70 km across (Fig. 4.1; Oswald *et al*. 2001, fig. 6.5). Their locations range from the middle of a downland block, as at Robin Hood's Ball, to the chalk edges at Whitesheet and Hambledon Hill, the latter on a separate hill just off the main downland edge (Fig. 4.1). Also on hilltops are a possible enclosure inside Scratchbury Camp, Norton Bavant, and the next two nearest possible outliers to the west, South Cadbury and Ham Hill (Oswald *et al*. 2001, fig. 6.5). It is worth noting that aerial photographic coverage of this area has been mixed, and we cannot certainly exclude the possibility of the discovery of more sites, for example on the Dorset Ridgeway, between Maiden Castle and Hambledon Hill, or for a long way east of Hambledon Hill, where the distribution is very sparse.[2]

Scratchbury Camp, a possible causewayed enclosure in the Wylye valley in Wiltshire, has seen minimal excavation (Oswald *et al*. 2001, 157). There have, however, been important excavations at Robin Hood's Ball, Whitesheet Hill, Hambledon Hill, and Maiden Castle, starting with Mortimer Wheeler's work at Maiden Castle in the 1930s. Hambledon Hill has already been the subject of an extensive radiocarbon dating and modelling programme (Healy 2004; Mercer 2004; Bayliss *et al.* 2008a; and see Chapter 1). The opportunity has been taken here to re-model its results in line with the rest of this project, though no new samples have been dated. New samples were obtained from Robin Hood's Ball, Whitesheet Hill and Maiden Castle.

4.1 Hambledon Hill, Child Okeford, Iwerne Courtney or Shroton and Hanford, Dorset ST 8492 1226

Location and topography

Hambledon Hill lies in north-east Dorset, where it forms part of the north-west scarp of the Wessex chalk, cut off from it by the river Stour to the west and its tributary the Iwerne to the east. The massif consists of a central dome up to 350 m in diameter, rising to 192 m OD at the highest point of the hill, from which radiate three main spurs, the hillfort spur to the north, the Shroton spur to the east, and the Stepleton spur to the south, with the Hanford spur jutting from its western side (Fig. 4.2). Whereas the tip and sides of the hillfort spur are steep, the other spur tips slope gently to the valley floors and provide the easiest access to the hill. The Upper Chalk is confined to the central dome of the hill and the immediately adjoining parts of the hillfort and Stepleton spurs, with Middle Chalk lower down the spurs and Lower Chalk around the flanks. To the east is the extensive chalk downland of Cranborne Chase, largely rendered invisible by the immediately facing slopes. Chalk downland rises again to the south-west. To the west and north-west the chalk gives way to Greensand, Gault and the low-lying Vale of Blackmoor, which is based mainly on Kimmeridge and Oxford Clays. The hill thus has an open prospect towards Sherborne, Castle Cary, and the southern limits of the Somerset Levels. Conversely, it is visible as a prominent landmark from much of the surrounding area to the west and north-west, at least in current conditions of relatively open vegetation. While part of the Wessex chalk, Hambledon Hill is thus at the edge of that world, and at its boundary with the distinctive landforms of the south-west, a location reflected in the predominance of the South-Western style among the Bowl pottery from the site (I. Smith 2008a). This location may have had much to do with the development and significance of the site.

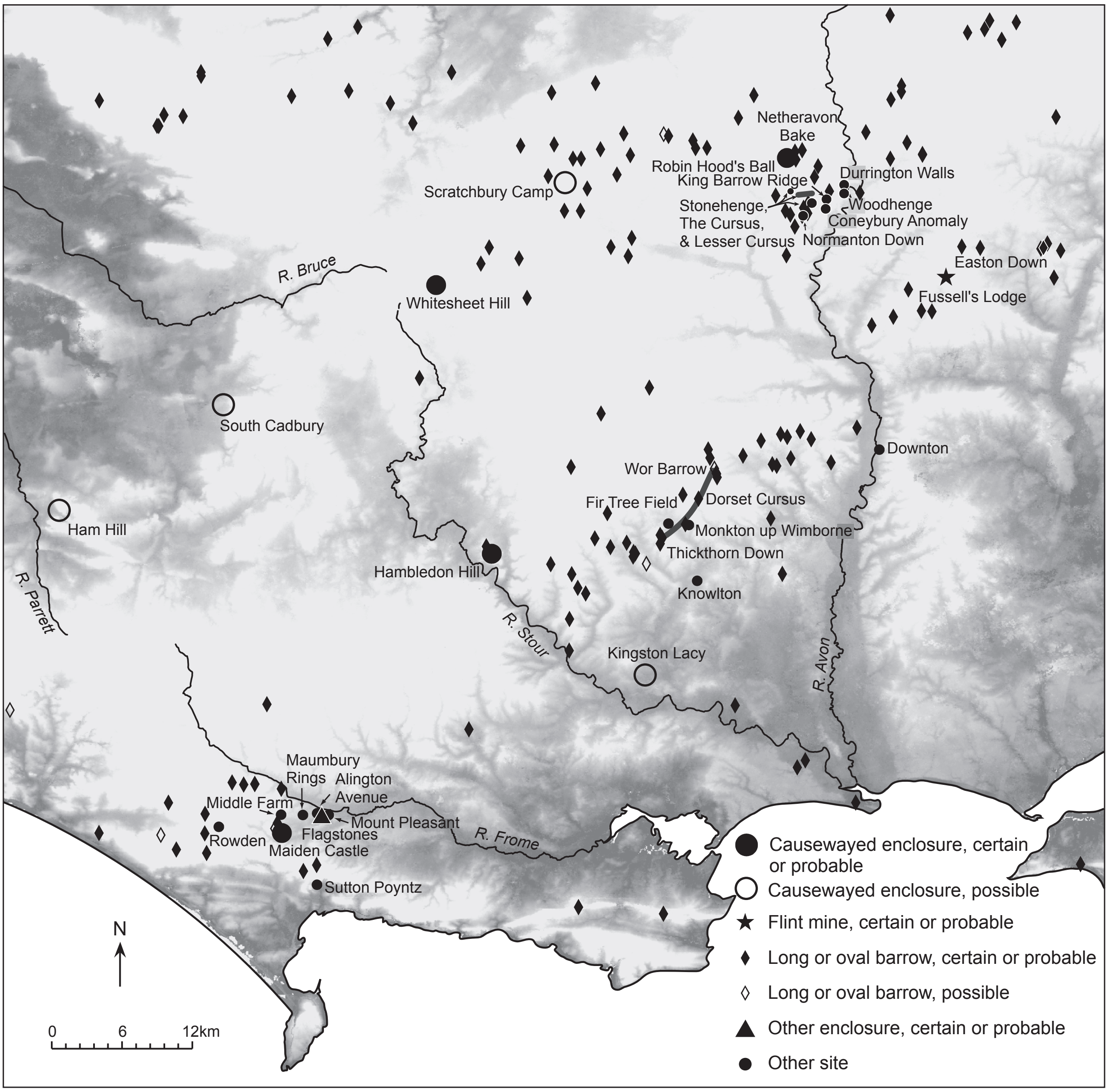


Fig. 4.1. South Wessex showing causewayed enclosures, long barrows and other sites mentioned in Chapter 4.

The scale and complexity of Hambledon Hill remain exceptional. The entire hill, for a distance of some 2 km from north to south and some 700 m from east to west, is occupied by Neolithic earthworks (Fig. 4.2; Table 4.1). The main enclosure on the central dome, one of the largest causewayed enclosures in England (8.3 ha), is divided from the radiating spurs by pairs of cross-dykes which may equate to the middle and outer circuits of other complex enclosures. A much smaller causewayed enclosure (just under 1 ha), the Stepleton enclosure, occupies the Stepleton spur; there are two long barrows, a massive trapezoid example within the hillfort and a smaller oval one just south of the main enclosure within the cross-dykes; and a sequence of linear outworks surround the more gently sloping parts of the hill.

The hill lies at the western edge of Cranborne Chase, an area where Mesolithic, Neolithic and Bronze Age settlement, land use and ceremonial practice have been exceptionally well documented since the time of General Pitt Rivers (Bowden 1984), most recently by Barrett *et al*. (1991), M. Green (2000) and French *et al*. (2003; 2007). Salient features of the Neolithic and earlier archaeology of the Chase are extensive Mesolithic flint scatters (Barrett *et al*. 1991, fig. 2.3); the Fir Tree Field shaft, a natural formation containing stratified deposits spanning the fifth and fourth millennia cal BC (Allen and Green 1998; M. Green 2007a); numerous long barrows together with some Neolithic round barrows (Barrett *et al*. 1991, 36–43, 84–7); at least one and probably three long 'mortuary' enclosures (M. Green 2000, 55, 60, figs 31, 37); the Monkton-up-Wimborne pit circle

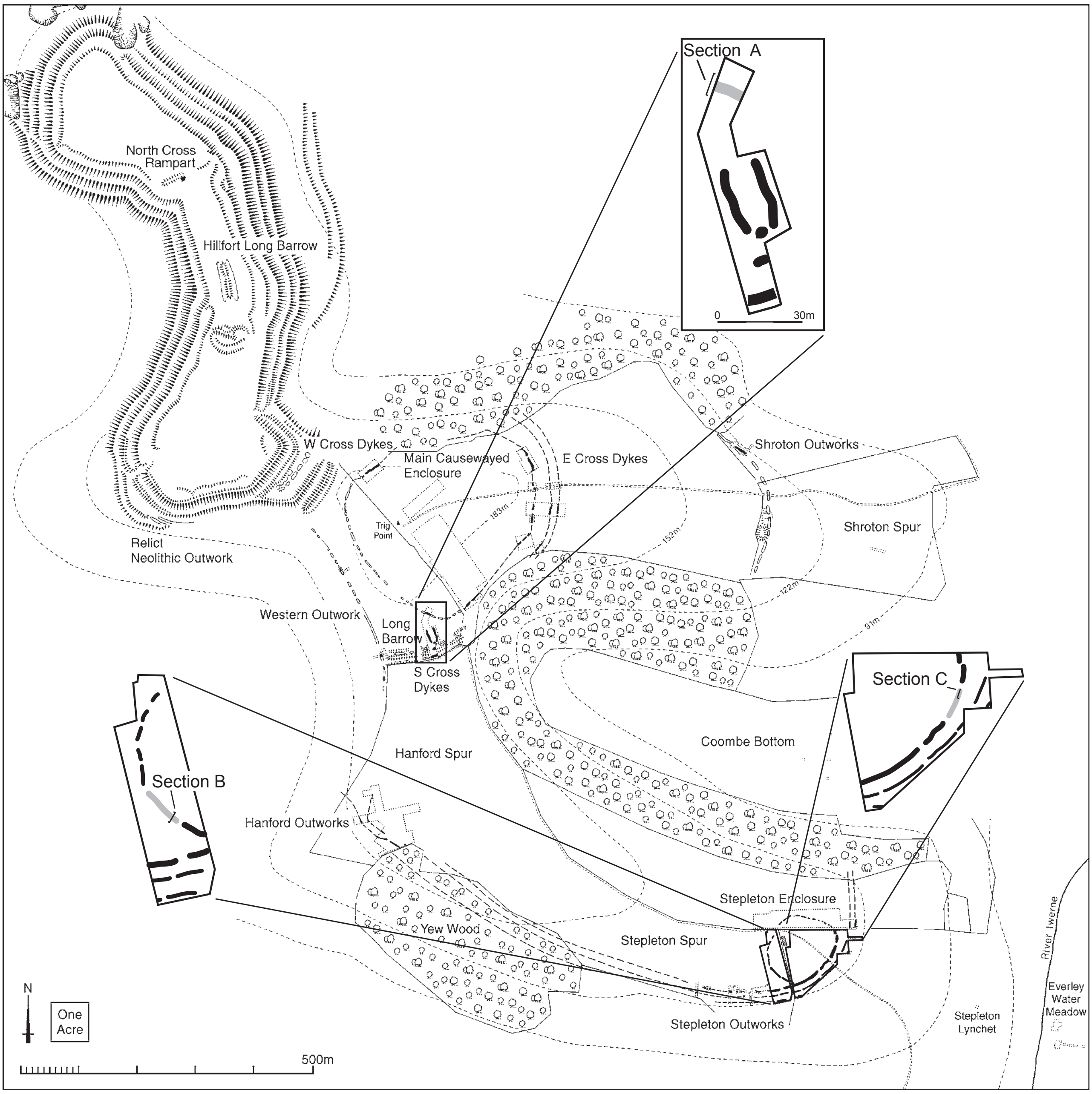


Fig. 4.2. Hambledon Hill. Plan showing excavated areas and location of sections reproduced here. After Mercer and Healy (2008, fig. 1.4).

and shaft complex (M. Green 2000, 77–85; 2007b); and the Dorset cursus, the largest monument of its kind in Britain, running, in its completed, two-part, form for 10 km (Barrett *et al*. 1991, 36–53; M. Green 2000, 57–62).

History of investigation

Antiquarian notice of the prominent and impressive hillfort on the north spur of Hambledon Hill goes back to the seventeenth century (Mercer and Healy 2008). Within that hillfort a transverse section was cut across the north long barrow and a hole dug in the centre of one round barrow at an unknown date or dates, and limited excavations by Edward Cunnington in 1894 recovered Iron Age and Roman material. Some of the Neolithic earthworks, including the main enclosure and cross-dykes, were recorded on the Ordnance Survey's first edition 25-inch map in the late nineteenth century (Oswald *et al*. 2001, fig. 2.1). In 1910, Heywood Sumner surveyed the main causewayed enclosure, the southern and eastern cross-dykes and the outwork on the east (Shroton) spur, together with the hillfort (Sumner 1913, 15, pl. I). After the First World War, pioneer archaeological aerial photography recorded further elements of the complex (Crawford and Keiller 1928, 44–7), which continued to be photographed in later decades.

In 1951 three trenches were cut across the ditch of the main causewayed enclosure in the west of the circuit, close

Table 4.1. Hambledon Hill, Dorset. Certain and possible pre-Iron Age features.

Element	Notes	Investigation
Main enclosure	Single causewayed circuit enclosing *c.* 8.3 ha	Sectioned in three small trenches by Sieveking and Erskine 1951 and in one by Bonney 1960, *c.* 20% excavated by Mercer 1974–6
Discrete features in central area	Pits unevenly distributed, some outside enclosure	At least 70 pits of certainly or probably Neolithic date excavated by Mercer 1974–82, when *c.* 15% of interior stripped
Inner east cross-dyke	Causewayed ditch and bank *c.* 280 m long, across neck of land between central dome and Shroton spur, parallel to and 7–10 m away from outer east cross-dyke	Sectioned in one trench by Bonney 1960, 47 m (*c.* 14%) excavated by Mercer 1975–6
Outer east cross-dyke	Causewayed ditch and bank *c.* 280 m long, across neck of land between central dome and Shroton spur, parallel to and 7–10 m away from inner east cross-dyke	Sectioned in one trench by Bonney 1960, 36 m (*c.* 13%) excavated by Mercer 1975–6
Inner south cross-dyke	Causewayed ditch and bank *c.* 170 m long, across neck of land between central dome and Stepleton-Hanford spur, parallel to and *c.* 8 m away from inner south cross-dyke, bowing around south long barrow	Sectioned in three trenches by Bonney 1958–9, further excavated by Mercer 1977 and 1982, bringing investigated length to *c.* 15 m (9%)
Outer south cross-dyke	Causewayed ditch and bank *c.* 170 m long, across neck of land between central dome and Stepleton-Hanford spur, parallel to and *c.* 8 m away from inner south cross-dyke, bowing around south long barrow. Most of Neolithic fill removed by Iron Age recut	Sectioned in three trenches by Bonney 1958–9, further excavated by Mercer 1977, bringing investigated length to *c.* 14 m (8%)
Inner north cross-dyke?	Across neck of land between central dome and hillfort spur, arguable on grounds of symmetry, but largely concealed by Iron Age earthworks	Vestiges tentatively identified by RCHME earthwork survey 1996 (Palmer and Oswald 2008)
Outer north cross-dyke?	Across neck of land between central dome and hillfort spur, arguable on grounds of symmetry, but largely concealed by Iron Age earthworks	Vestiges tentatively identified by RCHME earthwork survey 1996 (Palmer and Oswald 2008)
South long barrow	Mound *c.* 26 m long x 13 m wide, surrounded by U-plan ditch open to N	Damaged by recent flint-quarrying, bulldozed for agricultural purposes 1960s. Ditch and spread, displaced mound mound material completely excavated by Mercer 1977, after which they were reconstructed
North long barrow	Trapezoid mound sited along on a natural ridge in the middle of the hillfort spur, *c.* 70 m long x 17 m wide, standing to 2.5 m high, with probably segmented flanking ditches	Unexcavated except for an undocumented (antiquarian?) transverse trench
Western outwork	Causewayed ditch and bank at least 1650 m long, made up of shorter segments and more frequent causeways that the other outworks, extending from south of south cross-dykes, which it post-dates, along west side of central dome outside enclosure and along west side of hillfort spur beneath Iron Age ramparts	Identified by Palmer through earthwork and aerial photographic survey, subsequently sectioned in two trenches 2 m and 3 m wide and *c.* 125 m apart by Mercer 1982, extent further defined by RCHME earthwork survey 1996. Less than 1% excavated
Shroton spur outwork	Causewayed ditch and bank *c.* 290 m long running across the full width of the Shroton spur *c.* 330 m outside east cross-dykes	Sectioned in one trench by Bonney 1960, 23 m excavated by Mercer 1976, bringing excavated total to *c.* 8%
Outer Shroton outworks?	Two sets of elusive and undated earthworks east and downslope of definite Shroton spur outwork	One sectioned by Bonney 1958–60, further survey and inconclusive trenching by Mercer 1976, 1978, 1981
Stepleton enclosure	Single causewayed circuit enclosing just under 1 ha, close to tip of Stepleton spur	Almost completely excavated by Mercer 1978–81
Inner Stepleton outwork	Causewayed ditch and bank up to 300 m long, cut through SE part of Stepleton enclosure ditch and bank area of middle Stepleton outwork, and running west from enclosure along south side of spur parallel to middle and outer Stepleton outworks	*c.* 120 m (perhaps 40%) excavated by Mercer 1977–81
Middle Stepleton outwork	Causewayed ditch and bank up to 500 m long, running around outside of Stepleton enclosure and outside inner Stepleton outwork from north side to south side of spur	*c.* 50 m (perhaps 10%) excavated by Mercer 1978–81
Outer Stepleton outwork	Causewayed ditch and bank up to 500 m long, running around outside of Stepleton enclosure an outside inner Stepleton outwork from north side to south side of spur	*c.* 35 m (perhaps 7%) excavated by Mercer 1977–81
Discrete features on Stepleton spur	Unevenly distributed, some outside enclosure	Virtually all of interior excavated, including at least 80 Neolithic pits
Inner Hanford spurwork	Causewayed ditch and bank *c.* 160 m long, on shelving tip of Hanford spur	*c.* 20 m (12%) excavated by Mercer 1982

Element	Notes	Investigation
Outer Hanford spurwork	Causewayed ditch and bank *c.* 140 m long, on shelving tip of Hanford spur	*c.* 20 m (14%) excavated by Mercer 1982
Inner Stepleton-Hanford outwork	Causewayed ditch and bank perhaps 500 m long, joining middle (or inner?) Stepleton outwork and inner Hanford spurwork	Known only from earthwork and aerial photographic survey
Outer Stepleton-Hanford outwork	Causewayed ditch and bank perhaps 500 m long, joining outer (or inner?) Stepleton outwork and inner Hanford spurwork	*c.* 16 m (3%) excavated by Mercer 1982
Pits on Hanford spur	Dispersed	At least 7 Neolithic pits and one ?posthole excavated by Mercer 1982
Hanford 'flint mines'	*c.* 20 dark marks along both sides of Stepleton-Hanford spur, tending to follow the Upper/Middle Chalk boundary. Excavated examples were steep-sided quarries up to 1 m deep sunk to a thin seam of low quality tabular flint, which does not figure in the industries of the hill. Some joined to each other at base by undercuts or break-throughs	1 complex of conjoined pits and part of another excavated by Mercer 1982. Backfilled with clearly defined tips of soil rather than chalk rubble
Round barrows	One definite example, up to 5 others	Antiquarian trench in definite round barrow. Possible round barrows identified by Palmer 1976–82 and RCHME 1996
Fields	Some field boundaries on slopes of hillfort spur pre-date Iron Age ramparts, although others are later; Vestigial 'Celtic' field system on Stepleton-Hanford spur, between the two enclosures	Known from earthwork survey and aerial photography
Everley Water Meadow burnt mound	On the Iwerne floodplain below the Stepleton spur	Located by Palmer during fieldwalking. Partly excavated along with a palaeochannel section by Mercer 1982–4

to the hillfort, by Sieveking and Erskine (Farrar 1951). These showed that the ditches were causewayed, that their initial chalk rubble fills contained early/middle Neolithic artefacts and their secondary silts some later Neolithic and Beaker material, and that human remains were present. In 1958–60 Desmond Bonney of RCHME sectioned the main enclosure in the east, as well as sectioning the east and south cross-dykes and the Shroton outwork (RCHME 1970, 131; Oswald *et al*. 2001, fig. 3.12). This confirmed the date and character of the enclosure and showed the cross-dykes and outwork to be closely comparable to it in date and character. A human skull was found at the bottom of each of the east cross-dykes, and a pit containing Beaker pottery was cut into the inner one. These excavations were conducted as a part of RCHME's work on its *Inventory* for central Dorset (1970), in the course of which surveys were made of the main enclosure, the south long barrow between it and the south cross-dyke, the east, west and south cross-dykes, the east (Shroton) outwork, the still undated Stepleton enclosure with the outwork immediately around it, the hillfort and the long barrow and one round barrow within it, and some of the 'Celtic' fields (RCHME 1970, xxxix, 82–3, 104–5, 130–1, 342). Surface collections of Neolithic material, including a jadeitite axe of continental origin and a number of quern fragments (Evens *et al*. 1972), were made from the central area after it came under the plough in the 1960s.

By 1973 ploughing had brought large amounts of chalk bedrock into the soil, and was clearly eroding not only vestigial earthworks but any shallow subsoil features remaining in the interior. There ensued in 1974 the first of nine seasons of large-scale rescue excavation and associated survey, directed by Roger Mercer (Figs 4.2–3). Earthwork, air photographic and fieldwalking survey, principally by Rog Palmer, formed a part of the project from an early stage, and feedback between survey and excavation was particularly important in defining new questions, cuttings often being designed to investigate features identified in the field or on air photographs. Subsequently there were small-scale investigations to answer outstanding questions, in Everley Water Meadow in 1983 and 1984 and within the hillfort in 1986. The total area excavated amounted to some 4.25 ha. There were numerous interim publications (e.g. Mercer 1980; 1985, 1988; 1990; Saville 1990; Legge 1981).

By the end of the 1982 season, it was clear that the Stepleton enclosure was, like the main enclosure, of Neolithic date and that much of the hill was surrounded by linear outworks of the same period, sometimes double or even triple in parallel layout, one of them having been destroyed by fire. There was the possibility too of a third enclosure on the hillfort spur. Post-excavation analysis went forward in parallel with fieldwork and continued until 1987.

The complex played various roles in the interpretations and syntheses of the 1980s and 1990s. Mercer himself emphasised the evidence which it provided for warfare and for excarnation (1985; 1988; 1999). Julian Thomas dwelt on its peripheral location at the edge of the Chalk, perhaps

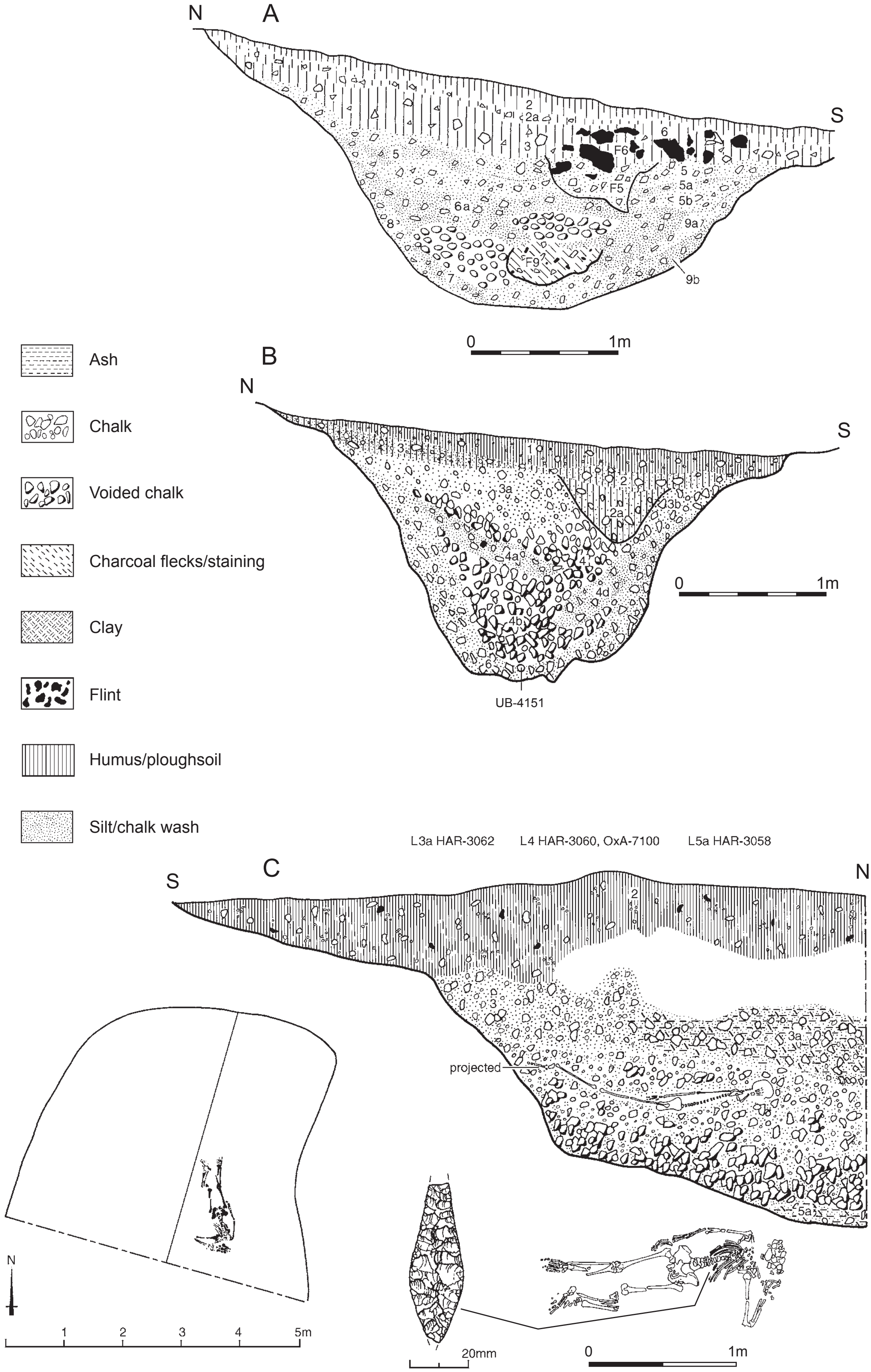


Fig. 4.3. Hambledon Hill. (1) Transverse section of segment 1 of the main enclosure ditch, (2) transverse section of segment 3 of the Stepleton enclosure ditch, and (3) longitudinal section of the north butt of segment 7 of the inner Stepleton outwork ditch, showing prone young adult male skeleton with arrowhead among ribs. The locations of the sections are shown in Fig. 4.2. After Mercer and Healy (2008, figs 3.7, 3.85, 3.102).

at the junction of territories, exchange systems, and upland and lowland pasture (1991, 32–8). Christopher Tilley (1994) saw the Neolithic earthworks as the formalisation of a 'hill island' already recognised by the Mesolithic population, and linked the hill to the Dorset cursus, along which 'bodies were perhaps being taken out of Cranborne Chase to a death island of the setting sun immediately beyond its margins to the west, and being allowed to decompose, with selected bones being returned to the barrows in the central ritual arena of the Chase itself. The pollution of death was thus being removed and dry, clean and ritually pure bones returned.' Mark Edmonds evoked the hill's power as an evolving encapsulation of the experience of millennia (1999, 1–10).

Full-time work on the project resumed in 1995, in order to bring it to publication, and up-dated interim statements were published (Saville 2002; Mercer 2004; Healy 2004; 2006). The main questions asked during the publication project concerned the full form and extent of the complex; the chronology of its construction and use; the articulation and function of its components; the ways in which it was built and their implications for contemporary resources, demography and social organisation; the genesis and nature of the numerous deposits of largely disarticulated human bone; the implications of the large assemblages of artefacts and food remains for the contemporary subsistence base and exchange networks; and the local context of the complex and its subsequent uses. The outcome (Mercer and Healy 2008) was predictably a multi-faceted picture. *Inter alia*, it emphasised the significance of the ecotonal location of the hill; showed that the Mesolithic presence was separated by more than four millennia from the start of Neolithic use; and demonstrated that fleshed bodies probably went through the whole process of excarnation, dispersal and burial on the hill itself, some flesh being cut from the bones. Above all, the chronology described below distributed both the human effort required to build the earthworks and the assemblage deposited in them over time in such a way as to suggest a reduction of the apparently massive scale of the society that had built and used the complex.

In 1996 RCHME conducted a further survey of the hill (RCHME 1996), with the dual purpose of providing English Heritage with a record of the current state of the hillfort for management purposes and of providing material for RCHME's investigation of causewayed enclosures (Oswald *et al*. 2001). This defined more fully the extent of the Neolithic western outwork, already known to continue along the side of the hillfort spur, all but obscured by the Iron Age ramparts.

Previous dating

Some of the earthworks were sequenced. The ditch of the inner Stepleton outwork cut that of the Stepleton enclosure and, in aerial photographs, appeared to cut the bank of the middle Stepleton outwork; the south cross-dykes bowed around the end of the south long barrow, suggesting that it had already been present when they were built; and the western outwork post-dated the south cross-dykes (Oswald *et al*. 2001, fig. 8.8).

Furthermore, by the 1980s, 34 radiocarbon dates were available, 30 of them from Neolithic contexts (Table 4.2). The first (NPL-76) had been measured in 1964 by the National Physics Laboratory, Teddington, on a sample excavated by Bonney. It was prepared according to methods outlined by Callow *et al*. (1963) and measured by GPC (carbon dioxide). Further details of error calculations are provided by Callow *et al*. (1965). Thirty measurements were completed by the laboratory at AERE Harwell between 1977 and 1989. Seven samples (HAR-2369–70, HAR-6038 and HAR-9166–9) were processed using the miniature GPC system (carbon dioxide); samples were prepared as described by Otlet and Warchal (1978), and were combusted to carbon dioxide, purified, and counted as outlined by Otlet *et al*. (1983; 1986). The remaining samples were processed using the standard LSC procedure at Harwell; samples were again prepared according to methods outlined by Otlet and Warchal (1978), but combusted to carbon dioxide and synthesised to benzene using a method similar to that initially described by Tamers (1965) and a vanadium-based catalyst (Otlet 1977). The radiocarbon content was measured using LSC as described by Otlet (1979). Samples dated by the Oxford Radiocarbon Accelerator Unit in the mid-1980s (OxA-931–33) were processed as described by Batten *et al*. (1986) and Wand *et al*. (1984) and measured using methods outlined by R. Hedges *et al*. (1989a).

These measurements were assessed and interpreted by Mercer (1988, 95–7, 104). The construction date of the main enclosure was seen as close to 2890 bc (*c*. 3600 cal BC), the mid-point of HAR-1886, singled out as measured on young wood. Dates from pits cut into its rubble fills (phase IV) were treated with scepticism because the samples could have been derived from the deposits into which the pits were cut. The subsequent cutting of slots (phase VI) into the silted ditch was seen as stretching over some hundreds of years, probably until after 2500 bc (*c*. 3200 cal BC), with the enclosure ditch redefined by users of Beaker pottery *c*. 2000 bc (*c*. 2500 cal BC). On the Stepleton spur, dates for the charred stumps of oak posts in the gateway of the inner outwork were recognised as measured on already old wood. All in all, there was seen to be 'a trend at Hambledon of a range of statistically indistinguishable dates centring around 2,800 bc' (*c*. 3575 cal BC) and it was suggested that the Stepleton complex persisted in use for perhaps a century or two from this central date. Measurements from other components of the site were not specifically discussed, and none were available from the south long barrow, the outer east and south cross-dykes, the western outwork, the Stepleton enclosure and the middle and outer Stepleton outworks.

Reassessment and modelling of existing dates

At the start of the 1996–9 dating programme the existing dates were modelled to provide a basis for subsequent

Table 4.2. Radiocarbon dates from Hambledon Hill, Dorset. Posterior density estimates derive from the model defined in Figs 4.7–13.

Stratigraphy in the Hambledon ditches is summarised by a series of 'phases', which are labels for stages in infilling rather chronological horizons. I: initial silts and other deposits on ditch bases; II: silts and other deposits overlying I; III: the main fill, occupying most of nearly every segment, consisting of chalk rubble, flint nodules, Clay-with-Flints where present, and finer material derived from the ditch sides and adjoining bank; IV: scattered pits, spreads, and occasionally larger features, overlying or cut into III, characterised by a powdery, ashy grey fill in the main enclosure and long barrow and by varying combinations of burnt material in the Stepleton enclosure; V: slower, finer silts with a predominantly earthy matrix, largely derived from the adjoining topsoil; VI: recuts (generally slot-like) and deposits along the line of largely silted ditches; VII: recuts and deposits post-dating VI.

Laboratory Number	**Sample reference**	**Material**	**Context**	**Radiocarbon Age (BP)**	**δ^{13}C (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Boreal and related samples								
OxA-7845	HN82 C123	Single fragment of *Pinus sylvestris* charcoal	HN82 F279, layer 4A. Pit on Hanford spur	8400±60	−24.9		7580–7330	
OxA-7846	HN82 C115	Single fragment of *Pinus sylvestris* charcoal	HN82 F279, layer 3A (Fig 3.4)	8480±55	−24.4		7600–7470	
OxA-7816	WOWK82 C31	Single fragment of *Pinus sylvestris* charcoal	WOWK area 3 F4. From the first of two successive sockets in a possible posthole within the protected chalk of the inner south cross-dyke bank	8725±55	−25.1		7960–7590	
OxA-8861	WOWK82 C4A	*Fraxinus excelsior* charcoal	WOWK area 3 F4. From the second of two successive sockets in a possible posthole within the protected chalk of the inner south cross-dyke bank	4780±45	−24.0		3650–3370	*3650–3510*
OxA-8862	WOWK C4B	*Fraxinus excelsior* charcoal	From the same context as OxA-8861	4690±45	−24.1		3640–3360	*3635–3555* (*47%*) or *3540–3425* (*48%*)
Main enclosure								
OxA-8855	HH76 1942	Cattle. Rib and metatarsal fragments	Segment 5 Q1 layer 8. From primary silt. Phase I	4805±45	−21.2		3660–3380	*3660–3510*
OxA-8852	HH76 2977	Cattle. Ilium fragment	Segment 6.2 layer 9. From primary silt. Phase I	4620±40	−22.0		3520–3340	*3620–3610* (*1%*) or *3520–3405* (*94%*)
OxA-8853	HH76 2976	Cattle or red deer. Ilium fragment	From the same context as OxA-8852, and 0.10 m from it	4790±45	−21.9		3660–3380	*3655–3505* (*93%*) or *3425–3405* (*2%*)
OxA-7775	HH76 2897	Cattle. Articulating radius and ulna	Segment 7, layer 9. From the primary silt, in bulk find with other animal bone. Phase I	4825±30	−21.6		3660–3530	*3660–3625* (*39%*) or *3590–3525* (*56%*)
OxA-8906	HH76 2900	Pig. Calcaneum	From the same context as OxA-7775	4820±45	−20.2		3700–3520	*3660–3515*
OxA-8854	HH76 2900	Cattle. Scapula fragments	From the same context as OxA-7775	4855±45	−20.9		3710–3530	*3675–3625* (*56%*) or *3600–3525* (*39%*)

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
OxA-7772	HH75 1067	Cattle. Horncore	Segment 9, layer 11. Primary silt. Phase I	4735±40	−20.8		3640–3370	*3640–3495* (*76%*) or *3460–3385* (*19%*)
OxA-7771	HH75 895	Pig. Distal femur fragment	Segment 9, layer 10. Primary silt. Phase I	4820±45	−20.6		3700–3520	*3660–3515*
OxA-7767	HH76 2144	Pig. Acetabulum and ilium fragments	Segment 16, layer 11. Primary silt. Phase I	4735±40	−19.7		3640–3370	*3640–3555*
OxA-7768	HH76 1948	Human. Femur from articulated skeleton of a juvenile	Segment 18, quadrant 2d. Burial cut into base of shallow subsegment, covered by flint cairn. Phase I or II	4810±45	−21.6	4803±33 (T'=0.0; T'(5%)=3.8; ν=1)	3650–3520	*3655–3615* (*46%*) or *3610–3545* (*49%*)
OxA-7769		Replicate of OxA-7768	OxA-7768	4795±50	−21.2			
OxA-7027	HH75 1214	Single fragment of *Corylus* sp. charcoal	Segment 9, layer 13. Localised lens of ashy grey silt directly overlying primary silt. Phase II	4645±40	−25.3		3630–3350	*3625–3600* (*3%*) or *3525–3390* (*92%*)
OxA-7824	HH75 1214	Single fragment of *Corylus* sp. charcoal	From the same context as OxA-7027	4695±45	−24.7		3640–3360	*3635–3555* (*26%*) or *3540–3385* (*69%*)
HAR-1882	HH75 2134	Bulked *Crataegus* sp. charcoal not twiggy (50% identified)	Segment 11, layer 11. From a single findspot in a band of cultural material deposited after fine initial silt had accumulated. Phase II	4560±90	−24.9		3630–2930	*3630–3590* (*5%*) or *3530–3315* (*90%*)
OxA-7773	HH76 2625	Human. Lowermost lumbar vertebra from articulated lower trunk and femurs of young/younger mature human male, cut-marked and dog-gnawed	Segment 6.1, interface of layers 9 and 8. Surface of phase II silts. Phase II/III	4765±45	−20.4	4742±29 T'=0.4; T'(5%)=3.8; ν=1	3640–3370	*3455–3375*
OxA-7774		Replicate of OxA-7773	From the same context as OxA-7773	4725±40	−20.5			
OxA-7028	HH75 1041	Single fragment of *Corylus* sp. charcoal	Segment 9, layer 12. Lens of ashy grey silt overlying layer 13 and separated from it by a thin run of chalky silt. Phase II/III	4735±40	−26.0		3640–3370	*3640–3495* (*76%*) or *3460–3385* (*19%*)
OxA-7029	HH75 1095	Single fragment of *Corylus* sp. charcoal	From the same context as OxA-7028	4900±40	−25.9		3770–3630	*3770–3635*
HAR-1886	HH75 846	Bulked sample of *Sorbus* sp. and *Corylus* sp., not twiggy (50% identified)	From the same context as OxA-7028	4840±150	−26.4		3970–3340	*3945–3390*

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-7770	HH75 749	Cattle. Radius	Segment 9, layer 9. Submitted as a sample from the primary silt. This layer number, however, proved to have been applied both to part of the primary silt and to at least one silty lens in the chalk rubble fills. The stage excavation had reached on the day the find was made suggests that the sample came from the latter. Phase I or III	4520±40	−22.1		3370–3080	*3370–3315*
OxA-7765	HH76 2077A	Cattle. Radius	Segment 19, layer 10. Submitted as a sample from the primary silt. This layer number, however, proved to have been applied both to part of the primary silt and to the overlying chalk rubble fill. It is unclear from which the sample came. Phase I or III	4705±45	−21.9		3640–3360	*3640–3490*
OxA-7766	HH76 2077B	Pig. Distal end of right humerus	From the same context as OxA-7765	4730±40	−20.0		3640–3370	*3640–3505*
OxA-7015	HH75 1585	Cattle. Articulated radius-ulna, and radial, ulnar, and intermediate carpals	Segment 9, layer 8A. Phase III	4690±60	−21.0	4712±42 T'=0.3; T'(5%)=3.8; ν=1	3640–3360	*3455–3365*
OxA-7016		Replicate of OxA-7015	From the same context as OxA-7015	4735±60	−21.0			
OxA-7097	HH75 932	Dog. Articulating metacarpals and phalanx	Segment 9, layer 8. In bulk find with other bones. Phase III	4855±60	−21.5	4865±33 T'=0.0; T'(5%)=3.8; ν=1	3710–3540	*3710–3630* (*90%*) or *3560–3535* (*5%*)
OxA-7098		Replicate of OxA-7097	From same context as OxA-7097	4870±40	−19.9			
OxA-7022	HH76 2808	Articulating cattle lumbar vertebra and sacrum	Segment 17, layer 10. In a bulk find with other bones. Phase III	4835±55	−21.3	4778±41 T'=2.5; T'(5%)=3.8; ν=1	3650–3380	*3610–3515*
OxA-7023		Replicate of OxA-7022	From the same context as OxA-7022	4700±65	−21.0			
OxA-7099	HH76 2785	Cattle. Articulating phalanges	In a bulk find with other bones. From the same context as OxA-7022	4830±30	−21.1		3660–3530	*3585–3525*
HAR-2370	HH76 Sa 40	Bulked *Quercus* sp. charcoal	From the same context as OxA-7022	5220±110	−24.9		3500–2920	*4330–4280* (*3%*) or *4270–3790* (*92%*)
HAR-1885	HH74 1245	Bulked *Crataegus* sp., and *Prunus* sp. charcoal (50% identified)	Segment 3 F1. Phase IV	4480±130	−25.0		4330–3770	*3630–3575* (*7%*) or *3535–3310* (*88%*)
HAR-2375	HH76 Sa 82	Bulked *Quercus* sp., *Corylus*/*Alnus* sp., and ?*Crataegus* sp. not twiggy	Segment 17, layer 9A. Ashy grey layer overlying chalk rubble fills and stratigraphically later than OxA-7099 and OxA-7022. Phase IV	4670±100	−25.8		3650–3090	*3640–3395*
HAR-2377	HH76 Sa 79	Bulked *Quercus* sp. from large timbers (50% identified)	From the same context as HAR-2375	4610±90	−25.4		3640–3020	*3635–3555* (*21%*) or *3540–3395* (*74%*)

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
OxA-7020	HH76 2745	Cattle. Articulating carpals	In a bulk find with other bones. From the same context as HAR-2375	4800±65	−21.1	4800±45 T'=0.0; T'(5%)=3.8; ν=1	3650–3370	*3565–3495* (*71%*) or *3455–3385* (*24%*)
OxA-7021		Replicate of OxA-7020	From the same context as HAR-2375	4800±65	−20.9			
OxA-7019	HH76 1354	Red deer. Articulating phalanges	In a bulk find with other bones. From the same context as HAR-2375	4725±60	−21.7	4670±40 T'=1.5; T'(5%)=3.8; ν=1	3630–3360	*3525–3395*
OxA-7058		Replicate of OxA-7019	From the same context as HAR-2375	4625±55	−22.2			
OxA-8851	HH77 358	Cattle. Articulated distal tibia fragment, astragalus and calcaneum	Segment 1 F5. The first of at least two slots cut into top of the silted ditch. Phase VI/a	4870±45	−21.8		3710–3530	*3680–3625* (*69%*) or *3590–3525* (*26%*)
OxA-8850	HH75 2007	Cattle. Articulated tibia and astragalus	Segment 10 layer 6B. Slot cut into top of the silted ditch. Phase VI	4810±50	−21.9		3700–3380	*3660–3510* (*91%*) or *3425–3380* (*4%*)
HAR-2369	HH76 Sa 31	Charred hazelnut shells	Segment 13, recorded as from layer 3 (phase V), but placed by measurements in layer 5. Layer 5 was the fill of a single slot cut into the ditch top, which was not yet recognised at this spot when the sample was excavated. Phase VI	4520±80	−22.6		3500–2920	*3520–3395* (*34%*) or *3385–3310* (*61%*)
OxA-8849	HH76 2218	Cattle. Three articulated phalanges	Segment 14 section k layer 9. Lower of two spreads of dark loam rich in cultural material dumped over slow silts in south-east butt of segment, the upper of which was cut by a slot. Phase VI/a	4855±45	−21.7		3710–3530	*3675–3625* (*56%*) or *3600–3520* (*39%*)
OxA-7017	HH76 2861	Cattle. Articulating phalanges	Segment 17, quadrant a, layer 8A. In bulk find with other bones, from lower of two slot-like recuts, stratigraphically later than OxA-7019, OxA-7058, OxA-7020, OxA-7021, HAR-2377, HAR-2375. Phase VI/a	4790±60	−22.1		3700–3370	*3455–3370*
OxA-7018	HH76 2787	Pig. Articulating metatarsals (third, fourth, and navicular-cuboid in two unfused parts)	In bulk find with other bones. From the same context as OxA-7017	4695±60	−20.3		3640–3350	*3470–3355*
OxA-7039	HH76 3046	Human. R femur from articulated burial of young juvenile	Segment 17, quadrant b. Grave cut into segment butt, probably when the ditch was already silted. Post-phase VI?	4550±60	−20.8	4557±42 T'=0.0; T'(5%)=3.8; ν=1	3500–3090	*3375–3320*
OxA-7040		Replicate of OxA-7039	From same context as OxA-7039	4565±60	−20.7			
UB-4269	HH76 2970	Cattle. Articulated distal tibia fragment, calcaneum, astragalus, navicular-cuboid, cuneiform and lateral malledus	Segment 18, quadrant 2b, layer 10. Interpreted as having lain in an undetected recut. Post-phase VI?	4562±27	−22.4±0.2		3370–3120	*3370–3330*
HAR-9169	HH75 1498	Bulked *Quercus* sp., *Corylus* sp., and *Crataegus* sp. charcoal	Segment 8, layer 6. At single findspot, in concentration of stylistically late Beaker pottery above slot. Phase VII/a	4140±100	−26.4		2920–2460	

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Inner east cross-dyke								
HAR-9168	HH75 1535	Bulked charcoal of *Corylus*/*Alnus* sp. not twiggy (50% identified). Remainder identified as *Corylus avellana*	Segment 4, cutting II, layer 11. Charcoal concentration in primary silt. Phase I	4660±100	−26.1		3650–3090	*3635–3335*
OxA-8863	HH75 1535A	Single fragment of *Corylus avellana* charcoal	From the same context as HAR-9168	4875±45	−25.0		3750–3530	*3680–3625* (*72%*) or *3585–3525* (*23%*)
OxA-8864	HH75 1535B	Single fragment of *Corylus avellana* charcoal	From the same context as HAR-9168	4880±45	−25.0		3760–3530	*3680–3625* (*76%*) or *3585–3530* (*19%*)
OxA-8856	HH75 313	Red deer. Antler tip with two very worn tines	Segment 4 cutting I layer 11. Primary silt. Phase I	4780±55	−20.7		3660–3370	*3655–3495* (*81%*) or *3440–3375* (*14%*)
OxA-8857	HH75 314	Cattle rib fragments	From the same context as OxA-8856	4955±45	−21.1		3910–3640	
OxA-8892	HH75 2052	Cattle radius fragment	Segment 5 cutting 3 layer 12. Primary silt. Phase I	4785±60	−21.3		3700–3370	*3655–3495* (*80%*) or *3440–3375* (*15%*)
OxA-8893	HH76 680	Two articulated cattle vertebrae found in articulation	Segment 1 quadrant 6 layer 5A. In compact butchery deposit including parts of two cattle and one caprine in top of silted ditch. Phase VII/a	4255±50	−21.9		2930–2700	
Outer east cross-dyke								
UB-4267	HH75 2171	Red deer. Antler beam and trez tine, worn, perhaps a pick	Segment 4, cutting 2, layer 10. From slight hollow in the base of segment butt. Phase I	4497±26	−23.3±0.2		3360–3090	*3355–3315*
Inner south cross-dyke								
UB-4268	HH77 2123	Cattle. Articulated astragalus, calcaneum, navicular-cuboid, lateral malledus, and cuneiform, butchered	Site P2, layer 2B. Sealed beneath the bank	4708±26	−22.8±0.2		3630–3370	*3635–3555* (*53%*) or *3535–3490* (*33%*) or *3470–3415*(*9%*)
NPL-76		*Quercus*, *Corylus* and possibly *Betula* charcoal (Callow *et al.* 1965, 158)	Bonney's trench A, 1958, ditch bottom. Phase I	4740±90	−25.0±1		3700–3350	*3695–3680* (*1%*) or *3665–3395* (*94%*)
OxA-7825	HH77 1198	Cattle. 3 articulating cervical and thoracic vertebrae	Site P2 layer 9. Found together close to HH77 1291, in recut through the phase III rubble fills. Phase VI	4730±30	−21.5		3640–3370	*3525–3495* (*3%*) or *3460–3370* (*92%*)
OxA-7826	HH77 1291	Cattle. 5 articulating lumbar vertebrae	From same context as OxA-7825. Found together close to HH77 1198	4560±30	−21.8		3370–3110	*3375–3325*

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
UB-4273	WOWK82 C33	Charred hazelnut shells	WOWK area 4, layer 7. From the second of three recuts in the tertiary fills of the western butt. Phase VI	4714±33	−23.9±0.2		3640–3370	*3515–3495*(*2%*) or *3470–3370* (*93%*)
Western outwork								
OxA-7815	WOWK82 C22	Single fragment of *Quercus* sp. Charcoal	WOWK area 2 F6. From a posthole in a scoop or platform inside western outwork ditch	4660±40	−25.0		3630–3350	*3625–3600* (*4%*) or *3525–3360* (*91%*)
South Long Barrow								
OxA-7848	HH77 1366	Cattle. Metatarsal	LB2 SIV layer 26. Primary silt of W barrow ditch. Phase I	4950±55	−21.6		3940–3640	*3685–3630* (*91%*) or *3560–3535* (*4%*)
OxA-8846	HH77 1367	Cattle. Scapula fragments	LB2 SIV layer 26. Primary silt of W long barrow ditch. Phase I	4875±40	−20.3		3710–3540	*3680–3630* (*80%*) or *3580–3530* (*15%*)
OxA-8847	HH77 1948a	Cattle. Proximal phalanx	LB2 SVII layer 26. Primary silt of W long barrow ditch. Phase I	4835±45	−21.4		3710–3520	*3665– 3620* (*40%*) or *3605–3520* (*55%*)
OxA-8848	HH77 1948b	Indeterminate animal bone fragment	From the same context as OxA-8847	4760±50	−21.6		3650–3370	*3640–3500*
OxA-8845	HH77 1018	Red deer. Antler crown	LB4 layer 17. Found with tip embedded in crumbling natural chalk of base of north-east long barrow ditch, surrounded and covered by primary silt. Phase I	4870±35	−21.1		3710–3540	*3680–3630* (*84%*) or *3565–3535* (*11%*)
OxA-7827	HH77 1256	Cattle. Scapula	LB3 SI layer 26. From silt layer overlying primary silts and underlying chalk rubble fills in SW barrow ditch. Phase II	4655±40	−21.3		3630–3350	*3630–3585* (*15%*) or *3530–3450* (*80%*)
OxA-7813	HH77 2241	Cattle. Articulating astragalus and distal tibia fragment	LB3 SIV layer 19. In bulk find with other bone from SE butt of SW barrow ditch. Phase III	4580±30	−21.3		3500–3130	*3495–3435*
UB-4270	HH77 Sa 167	Charred hazelnut shell	LB3 SII layer 17. From a spread of ashy, charred material directly overlying layer 19 in SE butt of SW barrow ditch, stratigraphically later than OxA-7813. Phase IV	4741±26	−23.7±0.2		3640–3370	*3440–3375*
OxA-7828	HH77 1403	Pig. 2 ?articulating metacarpals	LB5 layer 15. In bulk find with other bone from silts above the chalk rubble fill of NE barrow ditch. Phase V	4795±50	−21.4	4837±39 T'=2.0; T'(5%)=3.8; ν=1	3700–3520	*3705–3625* (*55%*) or *3600–3525* (*40%*)
OxA-7829		Replicate of OxA-7828	From same context as OxA-7828	4910±65	−20.6			

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
Discrete features in central area								
HAR-9167	HH75 559	Bulked *Quercus* sp., *Corylus* sp. and *Crataegus* sp. charcoal; remainder identified as *Corylus avellana*, *Quercus* sp., and Maloideae	Site B F14. From pit with group XVI stone axehead and 3 Neolithic Bowls, including two vessels in gabbroic fabric	4830±80	−25.9		3780–3370	*3780–3495* (*84%*) or *3460–3375* (*11%*)
HAR-9166	HH75 556	Bulked fragment of *Corylus*/*Alnus* sp. and a few fragments of *Quercus* sp. charcoal	Site B F57. From pit with large antler deposit and Neolithic Bowl pottery	4920±70	−27.5		3940–3530	*3945–3855* (*10%*) or *3820–3625* (*81%*) or *3585–3530* (*4%*)
HAR-2041	HH75 545	Red deer. Burnt antler fragment	From the same context as HAR-9166	4110±80	−23.4			
HAR-3061	HH77 Sa 41	Bulked Pomoideae, *Quercus* sp., and *Corylus* sp., all from large timbers	Site N F6, layer 3. From pit with large antler deposit and Neolithic Bowl pottery	4680±80	−25.4		3640–3130	*3635–3350*
Shroton spur outwork								
HAR-2368	HH76 Sa 26	Bulked *Quercus* sp. charcoal	Site M F8. From a possible posthole surviving to 0.13 m deep and containing abraded plain body sherds in a Neolithic Bowl fabric. Perhaps part of the Shroton spur outwork bank or gateway	4520±80	−25.2		3500–2920	*3520–3395* (*34%*) or *3385–3310* (*61%*)
OxA-7037	HH76 2864.	Dog. Articulated skeleton	Site K/L baulk, base of ditch. Phase I	4710±55	−19.9	4737±40 T'=0.5; T'(5%)=3.8; ν=1	3640–3370	*3640–3495*
OxA-7038		Replicate of OxA-7037	From the same context as OxA-7037	4770±60	−20.1			
UB-4148	HH76 2895	Red deer. Worn antler pick	Site L, base of ditch. Phase I	4753±27	−21.4±0.2		3640–3380	*3635–3515*
UB-4149	HH76 2650	Red deer. Worn antler pick	Site K, layer 9. Primary silt. Phase I	4756±20	−21.8±0.2		3635–3385	*3635–3550* (*76%*) or *3545–3515* (*19%*)
UB-4150	HH76 1387	Red deer. Worn antler pick with burning to the base of the beam	Site K, layer 9. 'Virtually on ditch bottom' (label), in primary silt. Phase I	4736±21	−22.3±0.2		3635– 3380	*3635–3555* (*73%*) or *3540–3505* (*22%*)
OxA-7830	HH76 1608	Dog. Articulated skeleton	Site L, layer 6. In secondary silts. Phase III	4705±35	−19.8		3640–3370	*3530–3485* (*23%*) or *3475–3370* (*72%*)
HAR-2371	HH76 Sa 47	Bulked unidentifiable charcoal and unidentified burnt matter	Site L, layer 7. From a patch of burnt material in chalk rubble of L7. Phase III	4680±110	−27.5		3660–3090	*3650–3330*

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
HAR-2372	HH76 Sa 46	Bulked *Quercus* sp. and *Corylus*/*Alnus* sp. not twiggy charcoal; remainder identified as 55 fragments *Corylus*/*Alnus* sp., one fragment *Quercus* sp., and one unidentifiable	From the same context as HAR-2371	4630±80	−27.2		3640–3090	*3635–3575* (*11%*) or *3535–3325* (*84%*)
HAR-2379	HH76 Sa 48, Sa 49, Sa 50	Bulked *Quercus* sp. (not twiggy) and *Corylus*/*Alnus* sp. (some twiggy) charcoal	From the same context as HAR-2371	4350±80	−26.3			
OxA-7102	HH76 1968	Human. Articulating first metatarsal and first phalanx of mature adult	Site L, layer 7. Found together, apparently in articulation, in localised group of jumbled bones from more than one highly incomplete individual, in same area as source of samples for HAR-2371, etc. Phase III	4890±35	−20.4		3720–3630	*3765–3740* (*3%*) or *3735–3720* (*1%*) or *3715–3635* (*91%*)
HAR-2378	HH76 Sa 62	Bulked *Quercus* sp. and *Corylus*/*Alnus* sp. not twiggy charcoal	Site K, layer 7. From a patch of burnt material in the chalk rubble of L7 near N butt, 7 m from source of samples for HAR-2371, etc. Phase III	4820±120	−26.4		3940–3350	*3930–3875* (*3%*) or *3805–3360* (*92%*)
OxA-7831	HH76 1904	Pig. Fitting ulna and radius, probably articulating	Site M, segment 2, layer 8. I bulk find with other bone. Phase III	4660±45	−19.7		3630–3350	*3520–3360*
OxA-7832	HH76 2887	Pig. Fourth and fifth metacarpals from the same individual	Site M, segment 2, layer 7. In bulk find with other bone from layer overlying context of OxA-7831. Phase III	4625±45	−19.7		3520–3340	*3520–3345*
Stepleton enclosure								
UB-4152	ST80 1886	Red deer. Worn antler pick	Segment 3, unit 13A, ditch base. Phase I	4792±20	−22.5±0.2	4781±18 T'=1.8; T'(5%)=6.0; ν=2	3640–3520	*3640–3620* (*17%*) or *3605–3525* (*78%*)
OxA-7042		Replicate of UB-4152	From the same context as UB-4152	4735±60	−21.8			
OxA-7043		Replicate of UB-4152	From the same context as UB-4152	4720±65	−21.8			
UB-4153	ST80 1881	Red deer. Worn antler rake	Segment 3, unit 13B, layer 6. Phase I	4740±19	−21.1±0.2		3635–3380	*3635–3555* (*85%*) or *3540–3515* (*10%*)
UB-4151	ST80 1882	Red deer. Antler pick, possibly worn	Segment 3, unit 13A, layer 6. Phase I	4772±19	−22.6±0.2		3640– 3520	*3640–3620* (*17%*) or *3610–3520* (*78%*)
OxA-7048	ST80 C41	Single fragment of Maloideae charcoal	Segment 3, unit 9B, layer 2A. Localised patch of burnt silty, vacuous, chalk rubble, possibly cut into underlying layers. Phase IV	4670±40	−24.9		3630–3360	*3525–3390*

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
OxA-7049		Single fragment of Maloideae charcoal	From the same context as OxA-7048	4740±45	−24.7		3640–3370	*3575–3485* (*50%*) or *3470–3380* (*45%*)
OxA-7050	ST80 C32	Single fragment of Maloideae charcoal	From the same context as OxA-7048	4730±40	−27.1		3640–3370	*3575–3485* (*47%*) or *3470–3380* (*48%*)
UB-4138	ST80 1156	Dog. Articulated skeleton	Segment 3, unit 9D, interface of layers 3B and 2. Phase IV	4648±21	−21.0±0.2	4630±19 T'=6.6; T'(5%)=3.8; ν=1	3500–3360	*3500–3430*
OxA-7041		Replicate of UB-4138	From the same context as UB-4138	4485±60	−20.4			
OxA-7814	ST81 3188	Human. R humerus from articulated upper skeleton of mature adult female	Segment 10, unit 1/unit 2 baulk, interface of layers 2 and 4.1. Phase IV	4680±30	−21.1		3630–3360	*3525–3390*
OxA-7926	ST81 1233	Sooty superficial residue from sherds of a Neolithic Bowl; same vessel as ST81 1228	Segment 7, unit 1, layer 2. Phase VI	4845±50	−29.9	4737±28 T'=6.9; T'(5%)=3.8; ν=1	3640–3370	*3425–3375*
OxA-7844	ST81 1228	Replicate of OxA-7926	From the same context as OxA-7926	4685±35	−28.0			
Middle Stepleton outwork								
OxA-7030	ST80 C53	Single fragment of Maloideae charcoal	Segment 6, unit 7, layer 4A. From grey, charcoally silt on ditch base. Phase I	4660±45	−26.6		3630–3350	*3640–3550* (*93%*) or *3475–3430* (*2%*)
OxA-7031		Single fragment of Maloideae charcoal	From the same context as OxA-7030	4690±45	−25.9		3640–3360	*3640–3540* (*94%*) or *3525–3495* (*1%*)
OxA-7927		Single fragment of Maloideae charcoal	From the same context as OxA-7030	4725±50	−26.2		3640–3360	*3645–3540*
OxA-7035	ST81 379	Caprine. Two articulating ovicaprid phalanges	Segment 11, unit 3, layer 5. From silt layer overlying primary silt and underlying chalk rubble. Phase II	4820±55	−20.5	4831±40 T'=0.1; T'(5%)=3.8; ν=1	3700–3520	*3600–3520* (*90%*) or *3425–3385* (*5%*)
OxA-7036		Replicate of OxA-7035	From the same context as OxA-7035	4845±60	−21.0			
OxA-7024	ST80 2224	Cattle. Articulating astragalus and calcaneum	Segment 5, unit 6, layer 4A/3A interface. From surface of ashy silt with charcoal overlying cleaner primary silt, found together, perhaps articulated, in a larger cluster of bone. Phase II	4855±60	−21.0	4788±46 T'=3.1; T'(5%)=3.8; ν=1	3650–3370	*3580–3495* (*73%*) or *3430–3375* (*22%*)
OxA-7025		Replicate of OxA-7024	From the same context as OxA-7024	4685±75	−20.8			

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
UB-4136	ST79 2152	Cattle. Articulated cervical and thoracic vertebrae	Segment 6, cutting 1, layer 4. From chalk rubble. Phase III	4598±22	−23.2±0.2		3495–3345	*3495–3465* (*27%*) or *3380–3340* (*68%*)
Inner Stepleton outwork								
OxA-7835	ST79 2025	Human. R femur of articulated older adult, possibly male	Area 2A F200. Tightly crouched in ploughed-down scoop in protected chalk of inner outwork bank	4855±45	−20.4		3710–3530	*3760–3740* (*1%*) or *3715–3620* (*82%*) or *3605–3535* (*12%*)
HAR-4437	ST80 C81	*Quercus* sp. charcoal from a mature timber	Area 3B F601. From large timber *in situ* in first of two successive sockets in posthole of gateway	5040±80	−24.6		3990–3650	*3975–3655*
HAR-4438	ST80 C80	*Quercus* sp. charcoal from a mature timber	Area 3B F603. From among charcoal fragments in posthole of gateway	4770±80	−25.3		3710–3360	*3715–3530*
OxA-8859	ST79 C34A	*Corylus avellana* charcoal	Segment 6 cutting 1N layer 4A. From what appeared to be the burnt, collapsed breastwork of the rampart on the floor of the ditch	4825±45	−25.9		3700–3520	*3700–3540*
OxA-8860	ST79 C34B	*Corylus avellana* charcoal	From the same context as OxA-8859	4810±45	−24.2		3660–3510	*3695–3675* (*3%*) or *3665–3535* (*92%*)
UB-4242	ST79 2726	Human. L femur of articulated older mature adult male	Segment 7, cutting 15/19, ditch base. At outer edge of the segment butt. Phase I	4738±28	−20.8±0.2		3640–3370	*3595–3495* (*83%*) or *3435–3385* (*12%*)
OxA-7101	ST78 2756	Human. R femur of articulated human neonate	Segment 9, sector 1, ditch base. In natural cleft at the outer angle of segment butt. Phase I	4815±35	−20.8		3660–3520	*3585–3515* (*92%*) or *3425–3405* (*2%*) or *3400–3385* (*1%*)
HAR-3058	ST78 Sa 83	Bulked *Quercus* sp., *Corylus* sp., and Pomoideae charcoal from mature timbers	Segment 7, quadrant 2, layer 5. From chalky primary silts with ash and charcoal. Phase I	4700±90	−24.9		3660–3130	*3650–3405*
HAR-4435	ST80 C23	*Quercus* sp. charcoal from a mature timber	Segment 4, U4, layer 6. From silt layer within and near base of chalk rubble fills. Phase II	4880±90	−23.5		3940–3380	*3940–3855* (*7%*) or *3815–3500* (*88%*)

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC)* (*95% probability*)**
UB-4135	ST79 2578	Cattle. Articulating acetabulum and femur	Segment 5, cutting 4S, layer 5A. Found together in earthy silt derived from exterior, probably in a recut. Phase III/a	4644±21	−22.5±0.2		3510–3360	*3500–3420* (*56%*) or *3405–3395* (*2%*) or *3385–3360* (*37%*)
HAR-4433	ST79 C66	Bulked *Quercus* sp. charcoal from mature timbers	Segment 5, cutting 14, layer 5A. Phase III	4840±90	−24.5		3800–3370	*3910–3875* (*1%*) or *3805–3485* (*92%*) or *3470–3440* (*1%*) or *3435–3405* (*1%*)
UB-4137	ST79 601	Cattle. Articulated vertebrae	Segment 6, cutting 2N, layer 4. Phase III	4732±21	−22.4±0.2		3635–3375	*3530–3500* (*6%*) or *3435–3375* (*89%*)
OxA-7044	ST78 2755A	Human. L femur of articulated older subadult/young adult male	Segment 7, quadrant 4, layer 4. Prone in chalk rubble with leaf arrowhead in chest area. Phase III	4560±55	−20.7	4598±40 T'=1.1; T'(5%)=3.8; ν=1	3500–3130	*3500–3420* (*33%*) or *3385–3325* (*62%*)
OxA-7045		Replicate of OxA-7044	From the same context as OxA-7044	4645±60	−20.5			
OxA-7100	ST78 2755B	Human. Occipital vault fragments from among incomplete remains of young infant	Segment 7, quadrant 4, layer 4. Found at the left shoulder of ST78 2755A. Phase III	4770±30	−20.4		3640–3380	*3640–3515*
HAR-3060	ST78 Sa 121	Bulked *Quercus* sp. and *Corylus* sp. charcoal from mature timbers	Segment 7, quadrant 2, layer 4. Phase III	4570±90	−25.4		3630–3010	*3635–3550* (*26%*) or *3540–3410* (*69%*)
OxA-7026	ST79 1098	Sheep. Femur shaft	Segment 5, cutting 11S, layer 3B. From silts above chalk rubble in dump of post-cranial bones from two sheep (including articulating R and L forelimbs) with beaver hind limb. Phase V/1	4820±60	−21.2	4740±42 T'=3.6; T'(5%)=3.8; ν=1	3640–3370	*3640–3495* (*69%*) or *3455–3375* (*26%*)
OxA-7059		Replicate of OxA-7026	From the same context as OxA-7026	4660±60	−21.4			
OxA-8858	ST79 1098	Sheep. R humerus, articulating with radius and ulna	From the same context as OxA-7026	4855±45	−21.1		3710–3530	*3715–3620* (*70%*) or *3605–3520* (*25%*)

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
HAR-3062	ST78 Sa 118	Bulked *Quercus* sp. and Pomoideae charcoal from mature timbers; remainder identified as *Quercus* sp., *Corylus*/*Alnus* sp., and Maloideae	Segment 7, quadrant 2, layer 3A. In discrete charcoally area in silts overlying chalk rubble. Phase V/1	4850±70	−25.6		3780–3380	*3790–3505* (*91%*) or *3430–3380* (*4%*)
Outer Stepleton outwork								
UB-4243	ST80 1875	Human. R femur of articulated young adult male	Segment 3, unit 1, ditch base. Flexed in recess in angle of ditch butt, with arrowhead among ribs. Phase I	4679±27	−21.4±0.2		3630–3360	*3625–3605* (*4%*) or *3525–3365* (*91%*)
Discrete features on the Stepleton spur								
UB-4311	ST81 3181	Human. R femur of articulated young adult male	Area 4B, F712. Crouched on a layer of ashy grey silt, with burnt flint, charcoal, and charred hazelnuts in pit outside the Stepleton enclosure	4710±23	−21.3±0.2	4711±19 T'=0.0; T'(5%)=3.8; ν=1	3630–3375	*3630–3585* (*22%*) or *3530–3495* (*21%*) or *3455–3375* (*52%*)
OxA-7818		Replicate of UB-4311	From the same context as UB-4311	4715±40	−20.3			
OxA-7843	ST81 C326	Single charred hazelnut shell	Area 4B, F712, L1. From a group of hazelnut finds which appear to have been deposited with ST81 3181	4700±45	−26.1		3640–3360	*3635–3555* (*23%*) or *3540–3365* (*72%*)
OxA-7836	ST78 964	Human. L femur of articulated older infant/young juvenile	Area 1A, F70. Crouched in a pit in centre of the Stepleton enclosure	4695±40	−21.2		3640–3360	
OxA-7837	ST78 Sa 17a	Single grain of *Hordeum* sp.	Area 1A F110. From a pit within the Stepleton enclosure	4725±40	−23.3		3640–3370	*3635–3550* (*38%*) or *3545–3490* (*20%*) or *3465–3370* (*37%*)
OxA-7838	ST78 Sa 17b	Single grain of *Hordeum* sp.	From the same context as OxA-7837	4670±40	−23.1		3630–3360	*3630–3595* (*7%*) or *3530–3360* (*88%*)

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
OxA-7839	ST82 F39a	Single grain of *Triticum dicoccum*	ST82 F39. From a pit outside Stepleton enclosure	4750±40	−20.4		3640–3370	*3640–3495* (*76%*) or *3440–3375* (*19%*)
OxA-7840	ST82 F39b	Single grain of *Triticum dicoccum*	From the same context as OxA-7839	4730±45	−21.0		3640–3370	*3635–3495* (*62%*) or *3465–3375* (*33%*)
OxA-931	ST81 Sa 18	Single *Vitis vinifera* pip	Area 4B, F53. From pit outside Stepleton enclosure (Jones and Legge 1987)	4660±80	−25.0 (assumed)		3640–3120	*3635–3550* (*19%*) or *3540–3340* (*76%*)
OxA-932	ST81 Sa 18	Single grain of *Triticum dicoccum*	From the same context as OxA-931	4690±70	−25.0 (assumed)		3640–3340	*3635–3550* (*24%*) or *3545–3360* (*71%*)
OxA-933	ST81 Sa 18	Single grain of *Triticum dicoccum*	From the same context as OxA-931	4680±80	−25.0 (assumed)		3640–3130	*3635–3350*
Bronze Age features on the Stepleton spur								
OxA-7841	ST78 Sa 81a	Single grain of *Triticum dicoccum*	Area 1A, F227. From base of possible corn-dryer within Stepleton enclosure	3315±45	−23.7		1740–1490	
OxA-7842	ST78 Sa 81b	Single grain of *Triticum dicoccum*	From the same context as OxA-7841	3255±40	−24.1		1630–1430	
OxA-7849	ST82 124	Human. R femur from articulated mature/older adult male	ST82 F16. Crouched in a pit outside the Stepleton enclosure	3050±45	−21.2		1430–1130	
Outer Hanford outwork								
OxA-7850	HN82 304	Pig. Articulating astragalus, calcaneum, and navicular-cuboid	Segment 2, U7, layer 5C. Phase I	4755±35	−20.1		3640–3370	*3640–3505* (*82%*) or *3430–3380* (*13%*)
UB-4272	HN82 154	Cattle. Articulated pelvis and femur with cut marks	Segment 3, U1, base of ditch. Phase I	4476±26	−22.4±0.2		3340–3020	*3355–3310*
UB-4271	HN82 153	Cattle. Articulated lower vertebrae and sacrum	From the same context as UB-4272	4492±27	−22.6±0.2		3350–3030	*3355–3315*
HAR-6038	HN82 C113	Bulked unidentified charcoal	Segment 3, U6, layer 5C. From ashy silt on the base of the N butt of segment. Phase I	4530±110	−25.7		3630–2900	*3630–3580* (*6%*) or *3535–3310* (*89%*)

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Hanford 'flint mines'								
HAR-6037	HN82 C108	Bulked unidentified charcoal; remainder identified as *Corylus avellana*	HN82 F606, layer 3. Near base of pit, in break-through running N from F606	4270±100	−25.8		3270–2570	
OxA-7833	HN82 744	Red deer. Antler with significant evidence of wear	HN82 F644, layer 2. From undercut in wall near base of pit. Probably used to excavate the feature in which it was found	3810±45	−22.7		2460–2130	
OxA-7834	HN82 774	Two possibly articulating cattle caudal vertebrae	F601, layer 3. In backfill, 0.55 m deep	4425±45	−22.8		3340–2910	
Hillfort								
OxA-7776	HH86 118	Unidentified long bone fragment	From a lower fill of the earliest earthwork on the northern (hillfort) spur	2450±35	−21.5		770–400	
Everley Water Meadow								
HAR-6529	EWM83 61	Bulked, unidentified charcoal	Trench 2, layer 1A, section 2. From burnt mound	3160±70	−26.0		1610–1260	
HAR-6530	EWM84 292	Bulked, unidentified charcoal; remainder identified as *Prunus ?spinosa* and Maloideae	Trench 3, layer 4, section 6. From burnt mound	3090±80	−25.4		1520–1120	
HAR-6531	EWM84 331	Bulked, unidentified charcoal; remainder identified as Maloideae, *Quercus* sp., *Corylus avellana*, and *Acer campestre*	Trench 3, layer 4, section 6. From burnt mound	3070±70	−25.7		1500–1120	

sample selection, although this process is not described in the publication. It is set out here to provide uniformity with the other sites in this volume (Figs 4.4–6).

Almost all the Neolithic measurements available in 1996 were on bulk charcoal samples. Where these consisted of or included oak, which was sometimes described as large or mature, they are treated as *termini post quos* for their context. A minority which were made up of short-life charcoal or, in one case, of charred hazelnuts, are more likely to be close in age to their context, although they too may have comprised material of various ages.

The main enclosure (Fig. 4.5). Three of the existing dates (HAR-2370, -2375, -2377) relate to the same segment and can be sequenced with confidence. The remainder are modelled with them on the imperfect grounds that stratigraphically equivalent deposits in different segments were contemporary. It should be noted that this procedure was not adopted for the analyses presented in the final publication (Bayliss *et al*. 2008a). There were no samples from the floor of the ditch, although one collection of short-life charcoal (HAR-1882) came from a concentration of charcoal in a linear deposit placed along a segment after only fine initial silts had accumulated, and another (HAR-1886) came from a lens of ashy material tipped into a segment butt over pre-existing silts but before any chalk rubble had accumulated. These two measurements are not statistically consistent (T'=4.8; T'(5%)=3.8; ν=1), which may reflect heterogeneous origins. The only sample from the rubble fills (HAR-2370) was of oak charcoal, is older than either of them (T'=21.9; T'(5%)=6.0; ν=2), and is treated as a *terminus post quem*. HAR-2375 and -2377, from the layer immediately above it, are statistically consistent (T'=0.2; T'(5%)=3.8; ν=1) and are in good agreement with their stratigraphic position but are treated as *termini post quos* because one was of oak charcoal and the other contained oak charcoal. HAR-1885, from a stratigraphically equivalent deposit on the other side of the enclosure, was measured on short-life charcoal and is more recent (T'=7.2; T'(5%)=6.0; ν=2). HAR-2369, the only sample from the phase VI 'slots' cut into the silted ditch, was measured on hazelnuts and is comparable with HAR-1885 (T'=0.1; T'(5%)=3.8; ν=1). HAR-9169 (Table 4.2), measured on charcoal including oak from a single spot in a spread of Beaker pottery overlying the phase VI slot, does not relate to the primary Neolithic use of the enclosure and has not been included in this model.

On the basis of this model, the main enclosure was constructed in *3615–3355 cal BC* (*95% probability*; Fig. 4.5: *build main enclosure*), probably in *3500–3370 cal BC* (*68% probability*).

Pits within the main enclosure provided four samples, one of which (HAR-2041) was measured on burnt antler. Its late date (95% confidence; 2900–2460 cal BC; Table 4.2) is incompatible with the associated early Neolithic artefact assemblage. Given the problems of dating charred bone and antler, particularly the contamination of collagen by later humic material (Ambers *et al*. 1999, 331), it cannot be regarded as an accurate radiocarbon measurement and is

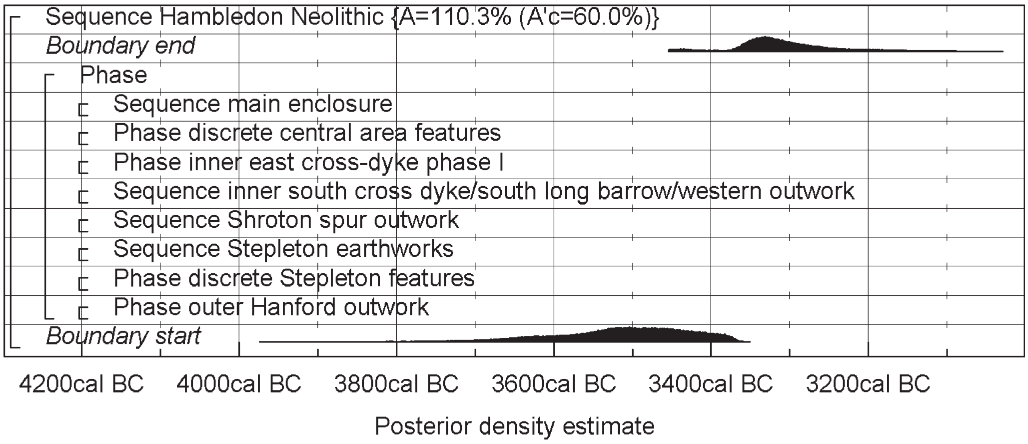


Fig. 4.4. Hambledon Hill. Overall structure of the chronological model using radiocarbon determinations obtained before 1996. The component sections of this model are shown in detail in Figs 4.5–6. The large square brackets down the left-hand side of Figs 4.4–6, along with the OxCal keywords, define the overall model exactly.

excluded from the model. The remaining three dates (HAR-3061, -9167 and -9166, the last of them from the same pit as HAR-2041) were measured on bulk charcoal samples including oak and are treated as *termini post quos*.

The inner east cross-dyke was dated by a single sample (HAR-9168). This was from a charcoal concentration in the initial silt on the base of the ditch and was of short-life charcoal. It could be close in age to its context and provides an estimated construction date of *3600–3305* (*95% probability*; Fig. 4.5: *HAR-9168*), probably of *3470–3350 cal BC* (*68% probability*).

The inner south cross-dyke also provided a sample from the base of the ditch (NPL-76), this time of charcoal which included oak. It is therefore treated as a *terminus post quem* and suggests that the ditch may have been cut in or after *3665–3365 cal BC* (*95% probability*; Fig. 4.5: *NPL-76*), probably in or after *3640–3490 cal BC* (*60% probability*) or *3460–3455 cal BC* (*1% probability*) or *3430–3405 cal BC* (*7% probability*). This would have been preceded by the construction of the south long barrow in *3620–3300 cal BC* (*95% probability*; Fig. 4.5: *build south long barrow*), probably in *3495–3355 cal BC* (*68% probability*) and followed that of the western outwork in *3510–3215 cal BC* (*95% probability*; Fig. 4.5: *build western outwork*), probably in *3430–3305 cal BC* (*68% probability*).

The Shroton spur outwork. Here, one of the samples was probably from a structural timber. HAR-2368 was made on oak charcoal from a vestigial posthole which formed part of what seemed to be a gateway in the earthwork on site M. The charcoal is likely to have been the remains of a post rather than an accidental introduction, since it was entirely of *Quercus* sp., and there was enough of it for a conventional date from the Harwell laboratory (then 50–100 g before pretreatment). The remaining samples were from two patches of burnt material in the chalk rubble fills on site K/L to the north. HAR-2378 came from a patch in the north-west butt of the segment. HAR-2371–2 and -2379 came from another in which there was a concentration of human remains. This latter deposit was described in the field as 'charcoal lumps and a lot of . . . unidentifiable burnt material – doesn't seem to be burnt wood as it is much more "spongy" with no definite lumps like charcoal frags. Seems to be stuck together and sometimes comes away in handful-size lumps with no particular shape', and unidentified, non-charcoal material formed part of the sample for HAR-2371. Given the small area of the deposit (*c.* 1.50 m by 0.70 m), this material may also have been a component of the other two samples. The three samples from the deposit yielded varying dates (T'=8.4; T'(5%)=6.0; ν=2), one of them, HAR-2379, being significantly later than the other two. The anomalous result might have resulted from contamination, and is therefore excluded from the model. Because of the oak or unidentified component of HAR-2378, -2371 and -2372, they have been used as *termini post quos* for their context.

The model indicates a construction date for the outwork of *3610–3240 cal BC* (*95% probability*; Fig. 4.5: *build Shroton spur outwork*), probably of *3480–3325 cal BC* (*68% probability*).

The inner Stepleton outwork. Here there were samples of clearly structural timber, from oak posts in the gateway, both of them mature (HAR-4437–8). Samples from the ditch fills were all of or dominated by mature oak. They formed sequences in two segments. In the lower fill in segment 5, HAR-4435 underlay HAR-4433. In segment 7, HAR-3058, -3060, and -3062 comprised samples from below, the same horizon as, and above the articulated skeleton of a young male found prone with a leaf arrowhead in the chest area (Fig. 4.3, bottom; Mercer 1988, fig. 5.IV. A). All these samples are treated as *termini post quos* for their contexts. Despite their diverse contexts the five ditch samples are not statistically significantly different (T'=8.8; T'(5%)=9.5; ν=4). Given convincing evidence for the firing and collapse of a timber-laced rampart, all or most of this charcoal could have derived from the original structure, although it entered the ditch at different times.

This uncertain basis provides an estimated construction date for the outwork of *3535–3210 cal BC* (*95% probability*;

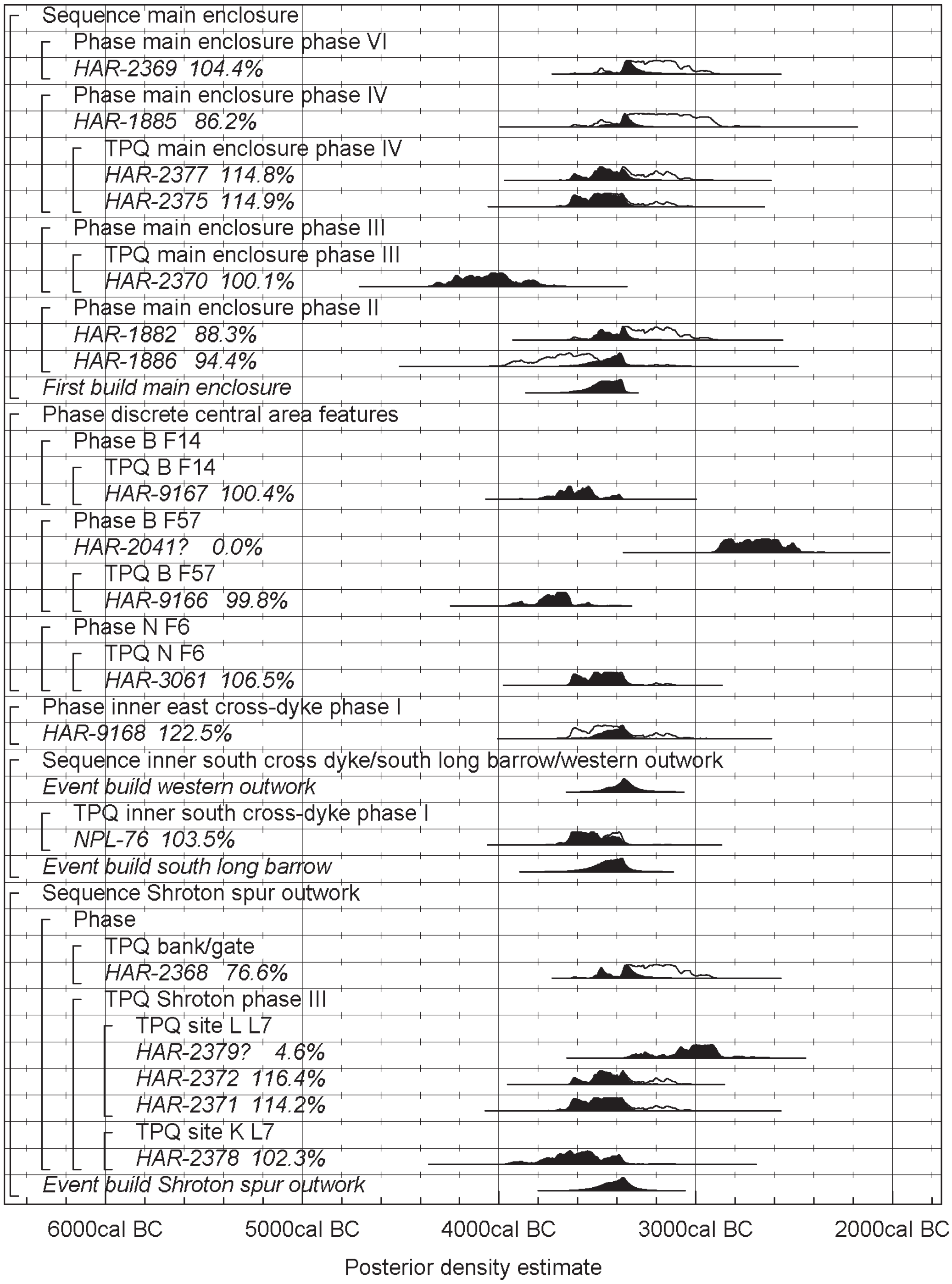


Fig. 4.5. Hambledon Hill. Probability distributions of dates obtained before 1996 from the central area and Shroton spur. Each distribution represents the relative probability that an event occurred at a particular time. For each of the dates two distributions have been plotted, one in outline which is the result produced by the scientific evidence alone, and a solid one which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution 'build main enclosure' is the estimated date for the digging of the main enclosure ditch. Dates followed by a question mark have been calibrated (Stuiver and Reimer 1993), but not included in the chronological model for reasons explained in the text. The overall structure of this model is shown in Fig. 4.4 and its other component is shown in Fig. 4.6.

Fig. 4.6: *build inner outwork*), probably of *3445–3310 cal BC* (*68% probability*), preceded by the construction of the Stepleton enclosure and the middle Stepleton outwork in *3630–3300 cal BC* (*95% probability*; Fig. 4.6: *build Stepleton enclosure and middle outwork*), probably in *3500–3355 cal BC* (*68% probability*).

The only dates obtained from pits on the Stepleton spur were three AMS measurements on a single charred grape pip and two charred emmer grains from the same feature (OxA-931–3; Jones and Legge 1987). All three are statistically consistent (T'=0.1; T'(5%)=6.0; ν=2) and are likely to date the deposit containing them.

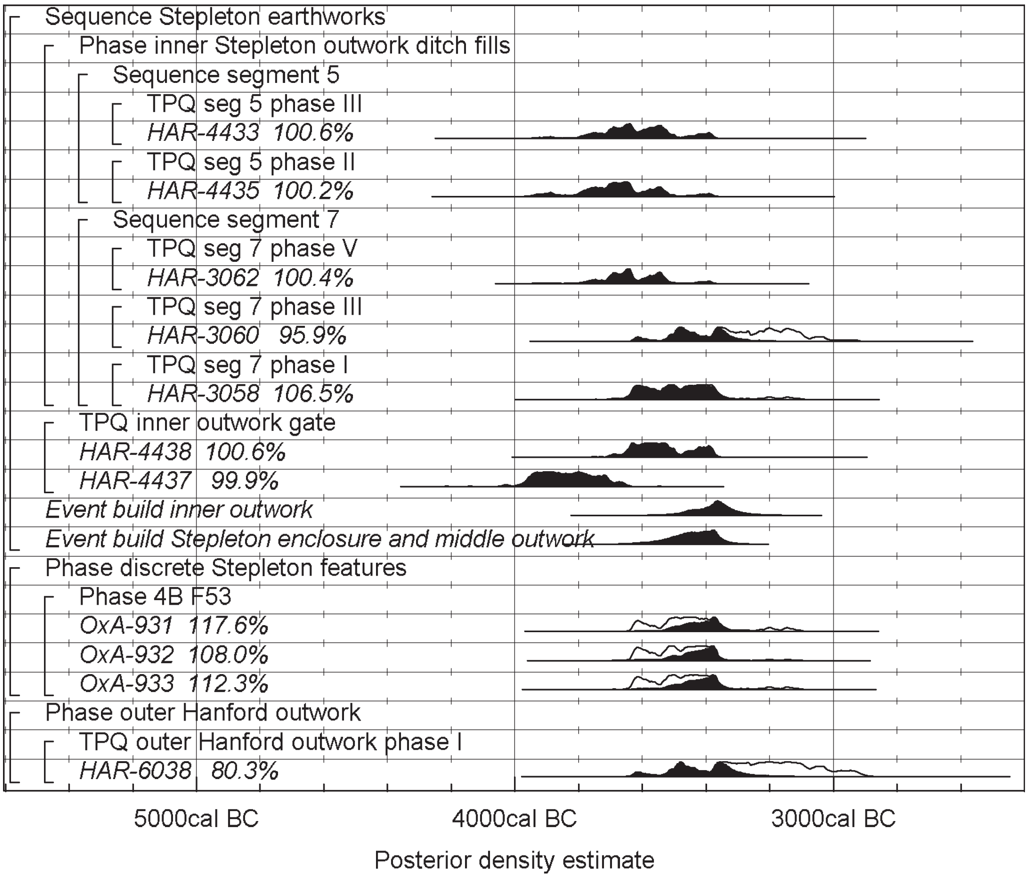


Fig. 4.6. Hambledon Hill. Probability distributions of dates obtained before 1996 from the Stepleton and Hanford spurs. The format is identical to that of Fig. 4.4. The overall structure of this model is shown in Fig. 4.4 and its other component is shown in Fig. 4.5.

On the Hanford spur, unidentified charcoal from ashy silt on the base of segment 3 of the outer outwork was dated by HAR-6038. This is taken as a *terminus post quem* for its context and places the cutting of this segment in or after *3635–3550 cal BC* (*9% probability*; Fig. 4.6: *HAR-6038*) or *3540–3245 cal BC* (*86% probability*), probably in or after *3520–3420 cal BC* (*37% probability*) or *3385–3305 cal BC* (*31% probability*). There remains the potential for a more recent construction date since, unconstrained by the model, the date calibrates to 3630–2900 cal BC (95% confidence).

The single date on short-life charcoal from the Hanford 'flint mines' (HAR-6037) is even more recent, to the extent that it shows poor agreement if included in the model. It suggests that the quarries were worked in 3270–2570 cal BC (95% confidence; Table 4.2).

The combination of heterogeneous samples and large standard deviations made for a limited outcome. Nothing was added to the sequence beyond the relationships already evidenced by stratigraphy, apart from the possibility of a slightly later date for the outer Hanford earthwork (Fig. 4.6). The Hanford 'flint mines' appeared to post-date the enclosures and outworks. The limits for the construction and initial use of the complex remained wide, with a start date of *3690–3365 cal BC* (*95% probability*; Fig. 4.4: *start*), probably of *3570–3395 cal BC* (*68% probability*) and an end date of *3455–3390 cal BC* (*7% probability*; Fig. 4.4: *end*) or *3380–3145 cal BC* (*88% probability*), probably of *3365–3260 cal BC* (*68% probability*).

Objectives of the 1996–9 dating programme

The principal aims of the 1996–9 dating programme were: to determine the date of construction of the major earthworks, establishing their sequence where direct stratigraphic relationships were absent and testing hypotheses formulated from other evidence such as earthwork survey; to establish the duration of the Neolithic use of the complex; and to establish the date of certain finds, such as isolated burials and assemblages of charred plant remains.

Sampling strategy and simulation

While suitable samples from some earthworks were abundant, none could be found from the outer south cross-dyke, where most of the Neolithic fill had been removed by a probable Iron Age recut; the inner Hanford outwork, where finds were scant except in one segment butt; and, necessarily, the unexcavated north long barrow. Sampling was further restricted by the scarcity of appropriate material from the western outwork and the suspected Neolithic enclosure ditch (which transpired to be Late Bronze

Table 4.3. Summary chronology of the construction and use of the early Neolithic earthworks on Hambledon Hill, Dorset. Posterior density estimates derive from the model defined in Figs 4.7–13.

		Distribution	***Posterior density estimate (95% probability)***	***Posterior density estimates (68% probability)***
Main enclosure	Construction	*build main enclosure*	*3675–3630 cal BC*	*3660–3640 cal BC*
	Last early/middle Neolithic use	*end main enclosure*	*3355–3310 cal BC*	*3345–3325 cal BC*
	Duration of early/middle Neolithic use	*use main enclosure*	*290–350 years*	*300–335 years*
Inner E cross-dyke	Construction	*build inner east cross-dyke*	*3690–3620 cal BC*	*3665–3640 cal BC*
Outer E cross-dyke	Construction	*UB-4267*	*3355–3315 cal BC*	*3345–3325 cal BC*
Inner S cross-dyke	Construction	*build inner south cross-dyke*	*3570–3390 cal BC*	*3505–3405 cal BC*
Western outwork	Construction (tpq)	*before western outwork*	*3510–3360 cal BC*	*3470–3395 cal BC (63%)* or *3380–3370 cal BC (5%)*
South long barrow	Construction	*build long barrow*	*3680–3635 cal BC*	*3665–3645 cal BC*
Shroton spur outwork	Construction	*build Shroton spur outwork*	*3640–3575 cal BC*	*3635–3600 cal BC*
	Reconstruction of gateway	*HAR-2368*	*3520–3395 cal BC (34%)* or *3385–3310 cal BC (61%)*	*3495–3465 cal BC (12%)* or *3375–3320 cal BC (56%)*
Stepleton enclosure	Construction	*build Stepleton enclosure*	*3640–3565 cal BC*	*3640–3615 cal BC (42%)* or *3610–3585 cal BC (26%)*
	Final early/middle Neolithic use	*end Stepleton enclosure*	*3425–3375 cal BC*	*3410–3375 cal BC*
	Duration of early/middle Neolithic use	*use Stepleton enclosure*	*165–255 years*	*195–250 years*
Middle Stepleton outwork	Construction	*build middle Stepleton outwork*	*3640–3585 cal BC*	*3635–3605 cal BC*
Inner Stepleton outwork	Construction	*build inner Stepleton outwork*	*3620–3515 cal BC*	*3580–3535 cal BC*
Outer Stepleton outwork	Construction	*UB-4243*	*3625–3605 cal BC (4%)* or *3525–3365 cal BC (91%)*	*3520– 3490 cal BC (16%)* or *3470–3395 cal BC (45%)* or *3385–3370 cal BC (7%)*
Outer Hanford outwork	Construction	*build outer Hanford outwork*	*3355–3320 cal BC*	*3350–3325 cal BC*
Entire hill	Beginning of early/middle Neolithic use	*start Hambledon*	*3685–3640 cal BC*	*3670–3650 cal BC*
	Final early/middle Neolithic use	*end Hambledon*	*3345–3305 cal BC*	*3335–3315 cal BC*
	Duration of early/middle Neolithic use	*use Hambledon*	*310–370 years*	*320–350 years*

Age) on the hillfort spur, only 5 m of each of which were excavated, as well as from the outer east cross-dyke, the outer Stepleton outwork and the outer Hanford outwork, all of which were poor in finds.

Once a pool of suitable material had been identified, sampling was initially focused on phases of activity within the most extensively excavated earthworks: the Stepleton enclosure, the inner and middle Stepleton outworks, the Shroton spur outwork, and the main enclosure. Simulations of the sequences in each were constructed, the selection of particular ditch segments for dating being largely determined by the availability of suitable samples in their upper levels.

Results and calibration

By these means a further 124 radiocarbon dates were obtained during the 1996–9 programme. Details of all the radiocarbon measurements are provided in Table 4.2.

Some results were unexpected. Pine charcoal from two apparently Neolithic features proved to date from the eighth millennium cal BC (Table 4.2: OxA-7816, -7845–6). A butchery deposit in the top of a segment of the inner east cross-dyke dated to the early third millennium cal BC (Table 4.2: OxA-8893). On the Hanford spur, 'flint mines' once seen as contemporary with the construction of the earthworks (Mercer 1987) dated to the later third millennium cal BC (Table 4.2: OxA-7833); two earlier samples from them were derived from backfill. On the Stepleton spur, a probable corn-dryer thought to relate to Neolithic occupation (Mercer 1988, 100) and a burial outside the Stepleton enclosure both dated to the mid- to late second millennium cal BC (Table 4.2: OxA-7841–2, -7849). A sample from the ditch of the possible third Neolithic enclosure on the hillfort spur dated to the early to mid-first millennium cal BC (Table 4.2: OxA-7776).

Analysis and interpretation

A full account of the samples, their contexts and the construction of the model is presented by Bayliss *et al*. (2008a), calculated using the datasets published by Stuiver *et al*. (1998b) and OxCal v3.3. Here the same model is recalculated to permit direct comparison with the other sites covered in this volume, using the datasets of Reimer *et al*. (2004) and OxCal v3.10. The overall structure of the main model is shown in Fig. 4.7 and its detail in Figs 4.8–13. The model is constructed on the premise that the use of the Neolithic earthworks forms a basically uninterrupted and continuous phase of activity and incorporates the known relationships between earthworks and between contexts within specific earthworks.

It should be noted that the unexpected results relating to earlier and later activity on the hilltop discussed in the previous sections are not shown on the graphs of the chronological model presented here (Figs 4.7–13). Three further results are not shown on these graphs, HAR-2041 and -2379, both of which may be unreliable on scientific grounds (see above), and HAR-9169, which consisted of bulked charcoal of a range of species including oak from a layer which contained stylistically late Beaker pottery.

An interpretive chronology

Figure 4.14 shows the probability distributions of the estimated dates for the construction of each of the dated earthworks. Posterior density estimates are shown in Table 4.3. By comparing each pair of distributions it is possible to calculate the probability that one earthwork was built before another. These probabilities are shown in Table 4.4. In two cases the estimates are older than those based on the pre-existing dates, the reverse of what might be expected from a series dominated by bulk charcoal samples. In the main enclosure, where the original estimate depended heavily on *HAR-1882*, this date is now refined to the earlier part of its wide distribution by measurements on articulating and short-life samples from comparable and overlying levels (Figs 4.8–9). In the Shroton spur outwork, dates on three antler picks and an articulated dog skeleton from the base of the ditch (Fig. 4.13: *UB-4148–50*, *HH76 2864*) made it clear that the post dated by *HAR-2368*, thought when the pre-existing dates were assessed to have been inserted when the earthwork was built, must have been part of a repair or renovation.

It is important to bear in mind that the model has produced date ranges of varying reliability, so that the probabilities in Table 4.4 are a best estimate and must be interpreted with caution. For example, it must not be forgotten that the posterior density estimate *before western outwork* is only a *terminus post quem* for that outwork and that estimates for the outer east cross-dyke and outer Stepleton outwork are based on single samples, albeit in the latter case a high-precision date on an articulated skeleton on the ditch base (Fig. 4.11: *UB-4243*). Nevertheless, certain patterns emerge from Table 4.4, which may be used to suggest a sequence of development for the complex (Fig. 4.14; Table 4.5).

Period 1A

In the central area, the estimated dates for the construction of the main enclosure, the inner east cross-dyke, and the south long barrow are very similar (Fig. 4.14; Table 4.3), falling in the mid-37th century cal BC, and centring on the 3650s and 3640s cal BC. No relative chronological sequence is apparent between these earthworks; indeed it is possible that all were built at the same time. For example, the difference between the construction dates of the main enclosure and the south long barrow is *−15–30 years* (*95% probability*; Fig. 4.15: *main enclosure/long barrow*), or *−10–15 years* (*68% probability*). This estimate means that, although it is not clear which earthwork came first, they are likely to have been built within 30 years of each other. Comparison of the dates of the first and last earthworks to be constructed in period 1A suggests that this activity (totalling 9630 worker days according to the

Table 4.4. Probabilities of the relative chronology of each pair of earthworks on Hambledon Hill, Dorset, derived from the model defined in Figs 4.7–13.

The cells show the probability that the earthwork listed at the left of the table is earlier than the earthwork listed at the head of the table, e.g. the probability that *build Shroton spur outwork* is earlier than *UB-4243* is >95%; the probability that *build Shroton spur outwork* is earlier than *build Stepleton enclosure* is 52% (i.e. 100% minus 48%).

	Main enclosure (*build main enclosure*)	**Inner E cross-dyke** (*build inner east cross-dyke*)	**Stepleton enclosure** (*build Stepleton enclosure*)	**Middle ST outwork** (*build middle Stepleton outwork*)	**Shroton spur outwork** (*build Shroton spur outwork*)	**Inner ST outwork** (*build inner Stepleton outwork*)	**Outer Hanford spurwork** (*OxA-7850*)	**ST78 2755A** (*ST78 2755A*)	**Outer ST outwork** (*UB-4243*)	**Inner S cross-dyke** (*build inner south cross-dyke*)	**Western Outwork** (*before western outwork*)	**Outer E cross-dyke** (*UB-4267*)	**Outer Hanford outwork** (*build outer Hanford outwork*)	**Shroton gateway** (*HAR-2368*)
Long barrow (*build long barrow*)	67%	69%	>99%	>99%	>99%	>99%	>99%	100%	100%	100%	100%	100%	100%	100%
Main enclosure (*build main enclosure*)		54%	>99%	>99%	>99%	100%	>99%	100%	100%	100%	100%	100%	100%	100%
Inner E cross-dyke (*build inner east cross-dyke*)			>95%	>95%	>95%	>99%	>95%	100%	>99%	>99%	100%	100%	100%	>99%
Stepleton enclosure (*build Stepleton enclosure*)				44%	48%	100%	82%	100%	>95%	>99%	100%	100%	100%	>99%
Middle ST outwork (*build middle Stepleton outwork*)					55%	100%	86%	100%	>95%	>99%	>99%	100%	100%	>99%
Shroton spur outwork (*build Shroton spur outwork*)						>95%	84%	100%	>95%	>99%	100%	100%	100%	>99%
Inner ST outwork (*build inner Stepleton outwork*)							48%	100%	92%	93%	>95%	100%	100%	>95%
Outer Hanford spurwork (*OxA-7850*)								94%	83%	81%	88%	100%	100%	93%
ST78 2755A (*ST78 2755A*)									22%	18%	29%	>95%	>95%	58%
Outer ST outwork (*UB-4243*)										40%	60%	100%	100%	76%
Inner S cross-dyke (*build inner south cross-dyke*)											100%	100%	100%	80%
Western Outwork (*before western outwork*)												100%	>99%	71%
Outer E cross-dyke (*UB-4267*)													40%	15%
Outer Hanford outwork (*build outer Hanford outwork*)														19%

Table 4.5. Provisional periodisation of the Neolithic use of Hambledon Hill, Dorset, derived from the model defined in Figs 4.7–13.

Period	Elements	Distribution	*Posterior density estimate (95% probability)*	*Posterior density estimate (68% probability)*
1A	Main enclosure	*first period 1A* (Fig. 4.14)	*3680–3640 cal BC*	*3670–3645 cal BC*
	Inner east cross-dyke	*last period 1A* (Fig. 4.14)	*3680–3615 cal BC*	*3655–3635 cal BC*
	South long barrow Hillfort long barrow?	*duration 1A* (Fig. 4.16)	*0–45 years*	*1–20 years*
1B	Shroton spur outwork	*first period 1B* (Fig. 4.14)	*3640–3605 cal BC*	*3640–3620 cal BC*
	Stepleton enclosure	*last period 1B* (Fig. 4.14)	*3630–3560 cal BC*	*3620–3580 cal BC*
	Middle Stepleton outwork	*duration 1B* (Fig. 4.16)	*1–65 years*	*5–40 years*
2	Inner Stepleton outwork	*first period 2* (Fig. 4.14) = *last period 2* (Fig. 4.14)	*3620–3515 cal BC*	*3580–3535 cal BC*
3	Inner south cross-dyke Outer Stepleton outwork Phases IV to VI in Stepleton enclosure	*first period 3* (Fig. 4.14)	*3640–3485 cal BC (92%)* or *3475–3440 cal BC (3%)*	*3635–3555 cal BC (58%)* or *3535–3520 cal BC (10%)*
	Skeletons with arrowheads in inner and outer	*last period 3* (Fig. 4.14)	*3510–3370 cal BC*	*3445–3375 cal BC*
	Stepleton outworks Outwork(s) on centre of Hanford spur?	*duration period 3* (Fig 4.16)	*30–235 years*	*85–200 years*
4	Outer cross-dykes?	*first period 4* (Fig. 4.14)	*3360–3320 cal BC*	*3350–3330 cal BC*
	Western outwork	*last period 4* (Fig. 4.14)	*3350–3310 cal BC*	*3340–3320 cal BC*
	Outwork(s) linking Stepleton and Hanford spurs Rebuilding of Shroton spur gateway Child burial and articulated animal bone deposit in segments 17 and 18 of main enclosure	*duration period 4* (Fig 4.16)	*0–25 years*	*0–15 years*

estimates given by Mercer (2008b) spanned *0–45 years* (*95% probability*) or *1–20 years* (*68% probability*) – the exploits perhaps of a single generation (Fig. 4.16: *duration 1A*; Table 4.5). The north long barrow is placed in this period by analogy with the south one.

Period 1B

After a generation or two (*−20–60 years* (*95% probability*); Fig. 4.15: *last 1A/first 1B*) or *5–35 years* (*68% probability*)), the construction of earthworks resumed. Away from the central area, the Shroton spur outwork, the Stepleton enclosure, and the middle Stepleton outwork cluster equally closely but slightly later, in the second half of the 37th century cal BC or the first decades of the 36th century cal BC. For example, the difference in construction dates of the Stepleton enclosure and the middle Stepleton outwork is *−65–40 years* (*95% probability;* Fig. 4.15: *Stepleton enclosure/middle outwork*), or *−30–20 years* (*68% probability*). The estimated date for the construction of the Stepleton enclosure takes account of a clear stratigraphic relationship between this ditch and the inner Stepleton outwork. The model also incorporates air photographic evidence that the middle outwork is earlier than the inner one. This relationship is less certain, although the radiocarbon evidence is in good agreement with it. Dates from the base of the Shroton spur outwork ditch place its initial construction in this period. Comparison of the dates of the first and last earthworks to be constructed in period 1B suggests that this activity (totalling 6940 worker days according to the estimates given by Mercer (2008b) spanned *1–65 years* (*95% probability*; Fig. 4.16: *duration 1B*; Table 4.5) or *5–40 years* (*68% probability*). It is possible that a 70 year-old could have witnessed the construction of all the monuments in this period within her or his lifetime.

The construction of earthworks in period 1 as a whole spanned *20–110 years* (*95% probability*; Fig. 4.16: *duration period 1*) or *35–80 years* (*68% probability*). It is probable that about a third of the eventual total labour input of the whole project (Mercer 2008b) was expended within two or three generations of the initiation of the enterprise.

Pre-construction activity

In the *central area* a cattle rib from the primary silt of the inner east cross-dyke (Fig. 4.10: OxA-8857) predates five other samples from the same context and may have been redeposited. Otherwise, there is little hint among the dates of previous Neolithic use of the central area, although the dating of skulls without mandibles, and indeed skull fragments, from primary contexts might tell a different story. There were Neolithic artefacts, animal bone and charcoal on the old land surface and in natural features beneath the main enclosure bank. Pre-bank pits (including pits in denuded bank areas), as distinct from postholes probably forming part of the bank structure, were confined to the inner south cross-dyke, attributed to period 3.

On the *Stepleton spur*, an older adult, possibly male (Fig. 4.12: *OxA-7835*), must have been buried before the

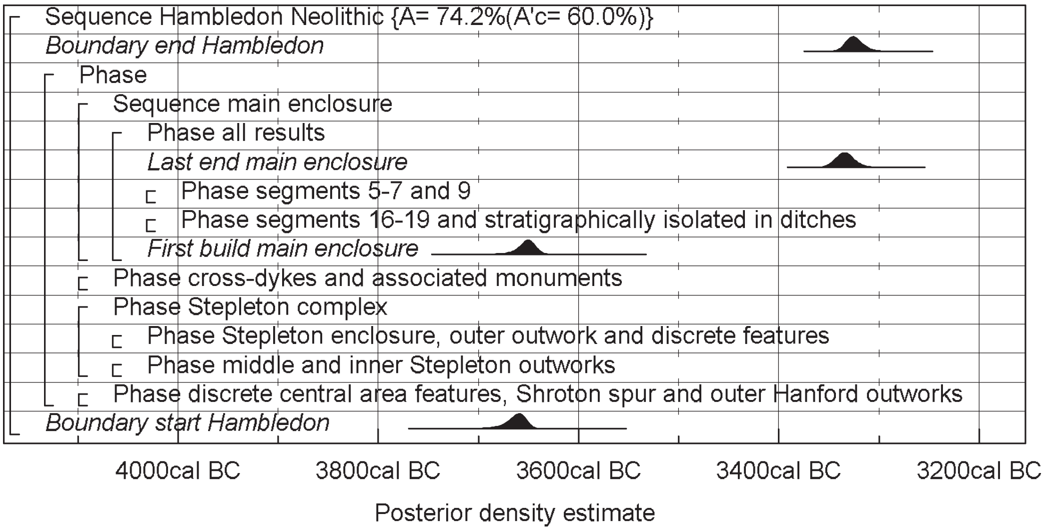


Fig. 4.7. Hambledon Hill. Overall structure of the chronological model (see Bayliss et al. *2008a figs 4.4–13 and 4.15–18). The format is identical to that of Fig. 4.4. The component sections of this model are shown in Figs 4.8–13. The large square brackets down the left-hand side of Figs 4.7–13, along with the OxCal keywords, define the overall model exactly.*

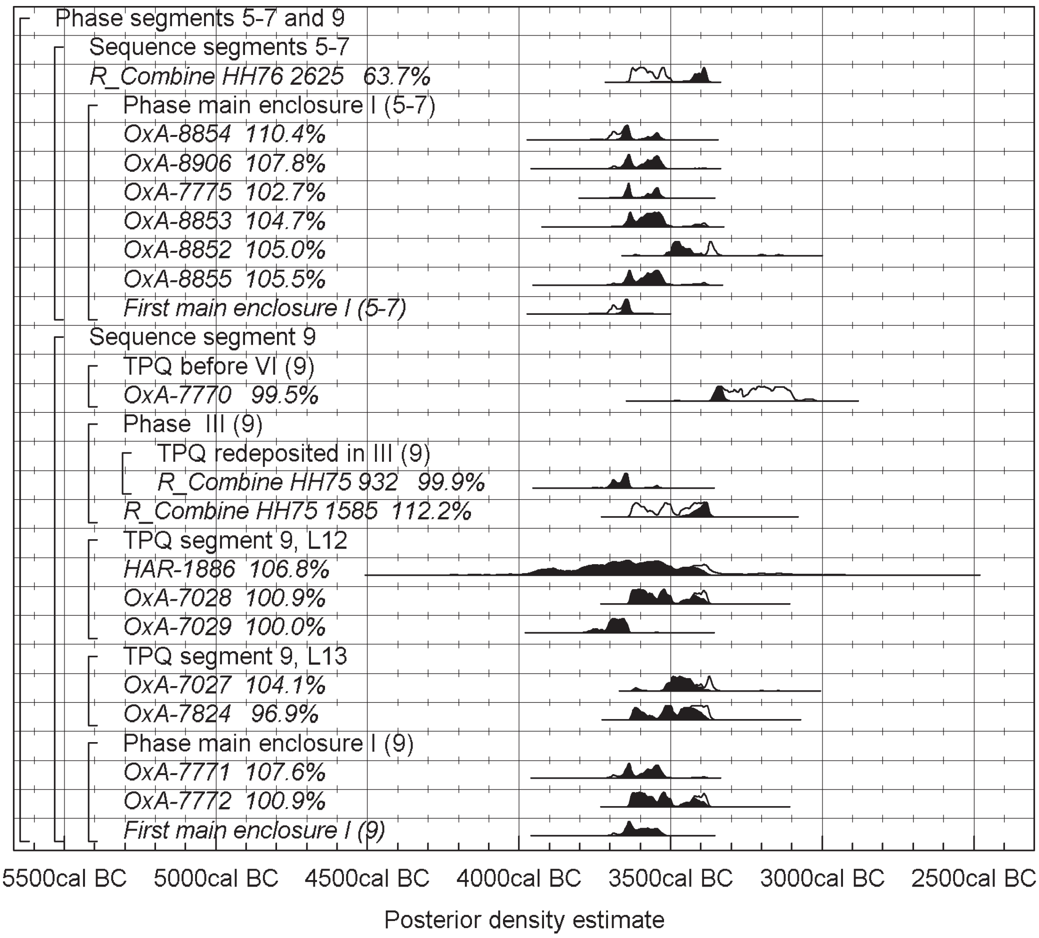


Fig. 4.8. Hambledon Hill. Probability distributions of dates from segments 5–9 of the main enclosure. The format is identical to that of Fig. 4.5. The overall structure of this model is shown in Fig. 4.7, and its other components in Figs 4.9–13.

inner Stepleton outwork was built, since the grave would have been covered by the rampart. The burial may be firmly placed in period 1, as must pits sealed by the inner Stepleton outwork bank.

On the *Shroton spur* the anomalously early date of apparently articulated foot and toe bones in a jumble of human remains in the chalk rubble fills (Fig. 4.13: *OxA-7102*) suggests that they, and perhaps the other bones in

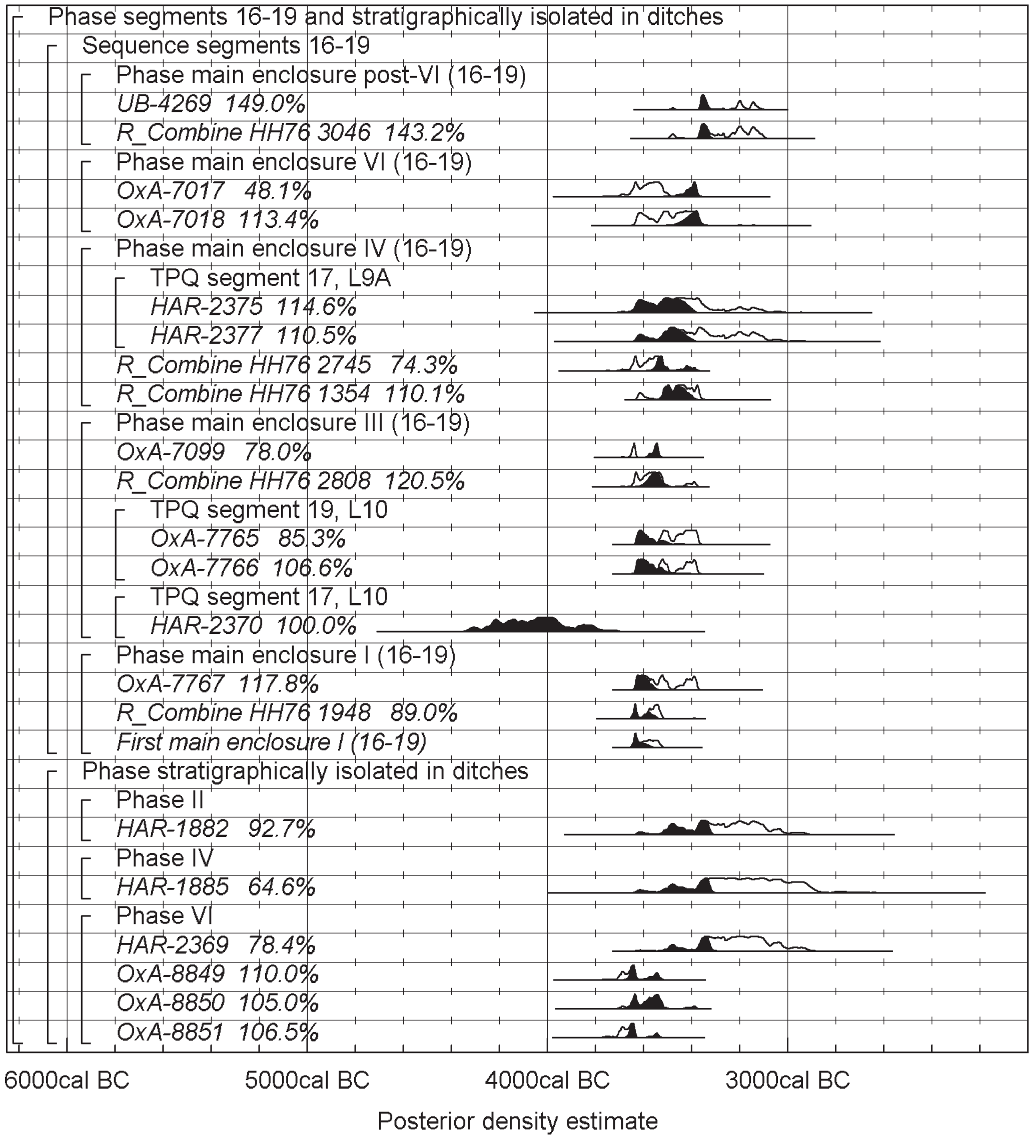


Fig. 4.9. Hambledon Hill. Probability distributions of dates from segments 16–19 of the main enclosure, and of other, stratigraphically isolated, samples from this enclosure. The format is identical to that of Fig. 4.5. The overall structure of this model is shown in Fig. 4.7, and its other components in Figs 4.8 and 4.10–13.

the group, might predate the construction of the earthwork (Fig. 4.13: *build Shroton spur outwork*).

Period 2

After an interval of *−20–95 years* (*95% probability*; Fig. 4.15: *last1B/first 2*), probably of *5–60 years* (*68% probability*), after the latest of the period 1 earthworks was constructed, the inner Stepleton outwork was built. This must be later than period 1, as it postdates the Stepleton enclosure and the middle outwork on stratigraphic grounds. Little time can have elapsed between the construction of this earthwork and its predecessor, however, as the measurements for skeletons from the base of the inner Stepleton outwork are statistically consistent with those for antler implements on the base of the Stepleton enclosure ditch (T'=5.6; T'(5%)=9.5; ν=4). It is quite possible that the builders of the inner outwork included individuals who remembered or had taken part in the construction of the Stepleton enclosure.

The inner Stepleton outwork was burnt and had at least partly collapsed immediately after its construction, with burning debris scorching the chalk and clay of the ditch floor. It may indeed have been built in anticipation of this apparent attack. A mature male found lying on the ditch base (Fig. 4.12: *UB-4242*) may have been a victim of the catastrophe in which the defences were fired, and a neonate placed in a crevice at the ditch base (Fig. 4.12: *OxA-7101*) must have died very close to this time. A direct connection with this conflict is seen in the contents of a grave 80 m to the north-east, where a young adult male was buried with scorched chalk rubble, burnt clay, charcoal, and charred hazelnuts. The only observed source for the burnt chalk and burnt clay was the then freshly burnt rampart, suggesting

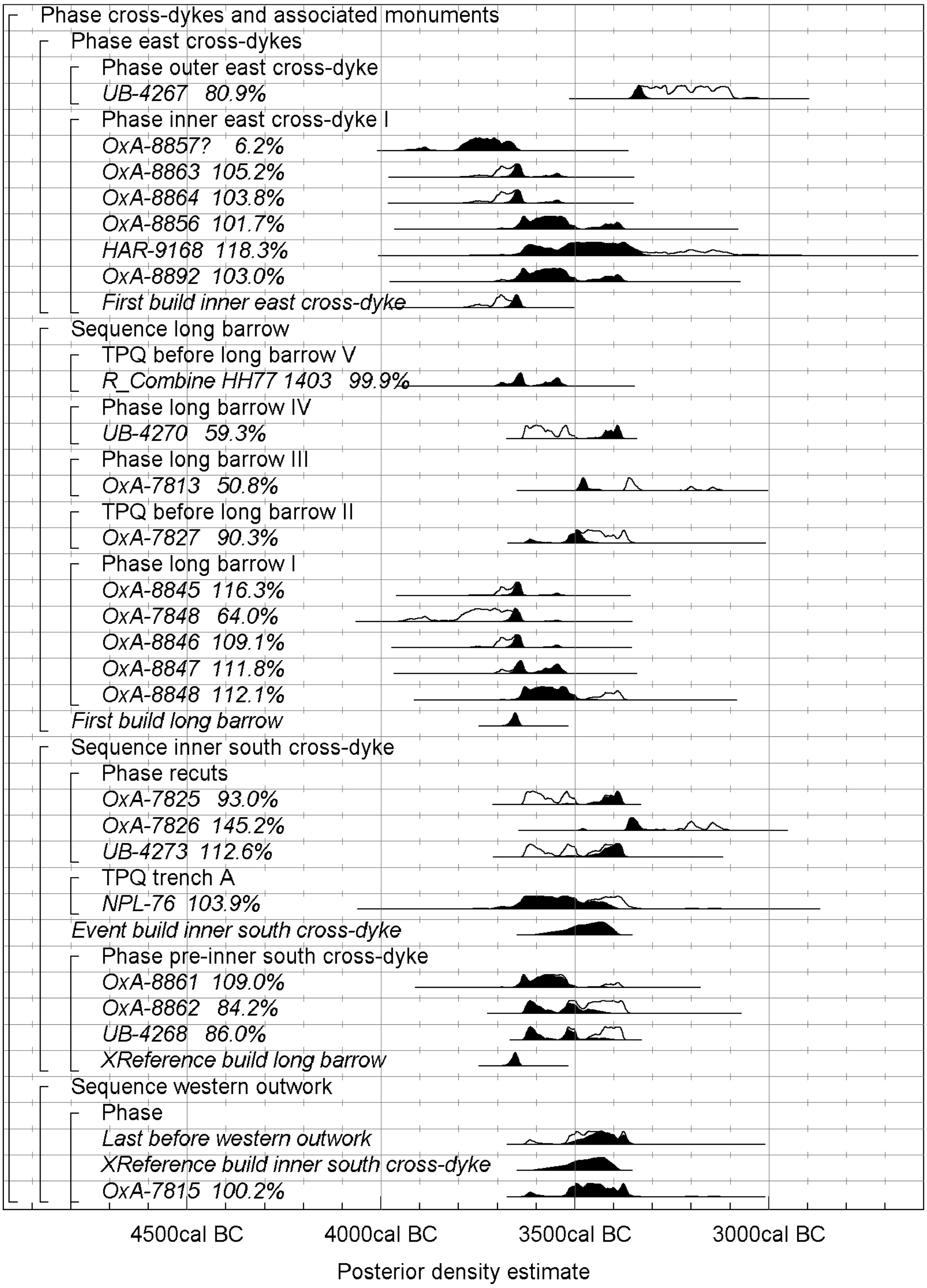


Fig. 4.10. Hambledon Hill. Probability distributions of dates from the cross-dykes, south long barrow, and western outwork. The format is identical to that of Fig. 4.5. The overall structure of this model is shown in Fig. 4.7, and its other components in Figs 4.8–9 and 4.11–13.

that his death was also associated with this event. Five radiocarbon dates, four made directly on the skeletons from the grave and the ditch, and one on one of the charred hazelnuts sprinkled in the grave, are consistent with the hypothesis that all three burials are part of the same event (T'=5.6; T'(5%)=9.5; ν=4). On this basis, we estimate that the inner Stepleton outwork was most probably constructed in the mid-36th century cal BC: *3620–3515 cal BC* (*95% probability*; Fig. 4.12: *build inner Stepleton outwork*), probably *3580–3535 cal BC* (*68% probability*). This single episode involved proportionally less labour, totalling 2420 worker days (Mercer 2008b).

The north-western part at least of the outer Hanford outwork may have been built before the period 4 outworks which linked the Hanford outworks to those on the Stepleton spur. On the evidence of a single measurement on articulating animal bone (Fig. 4.13: *OxA-7850*), this event could have occurred in period 2 or period 3.

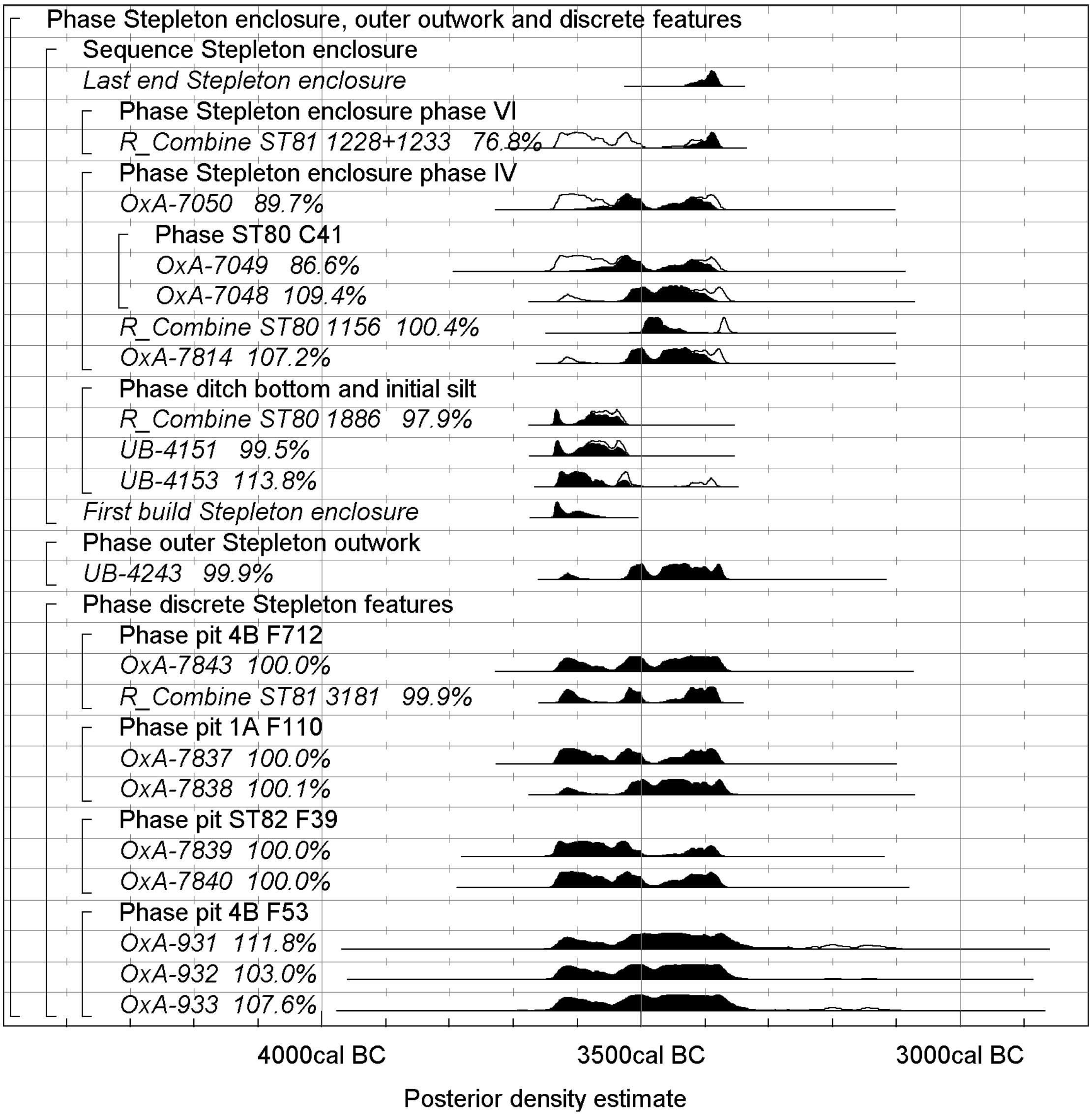


Fig. 4.11. Hambledon Hill. Probability distributions of dates from the enclosure, outer outwork and discrete features on the Stepleton spur. The format is identical to that of Fig. 4.5. The overall structure of this model is shown in Fig. 4.7, and its other components in Figs 4.8–10 and 4.12–13.

Once the main enclosure was built, individual segments infilled at different rates. Samples from phases III, IV and VI occupy a common span (Figs 4.8–9), indicating that the interplay between natural silting on the one hand and recutting, deposition, and backfilling on the other proceeded independently in individual segments or groups of segments. Regardless of date, different forms of intervention were nonetheless made in a consistent sequence; the ashy phase IV deposits, where they were made, always preceded the accumulation of phase V secondary silts; while phase VI slots were always cut after those had begun to accumulate (e.g. Fig. 4.3: section A). It is as if natural silting was delayed and interrupted to different extents in different segments, but the acts which were performed as it proceeded followed a common pattern which extended throughout periods 2, 3, and 4.

Period 3

After an interval of *−105–130 years* (*95% probability*; Fig. 4.15: *last 2/first 3*), probably *−70–40 years* (*68% probability*), various widely distributed features on the hill were built: the inner south cross-dyke, the putative inner north cross-dyke, perhaps the north-west part of the Hanford outwork, and the outer Stepleton outwork. Possibly with the exception of the construction of the outer Hanford spurwork (*OxA-7850*; Table 4.4), this activity is all significantly later than periods 1 and 2, falling in the 36th or 35th centuries cal BC (Fig. 4.14; Table 4.3). For example, it can be estimated that the difference between the dates of construction of the inner and outer outworks on the Stepleton spur is *between 15 and 220 years* (*91% probability*; Fig. 4.15: *inner/outer Stepleton outworks; −75–25 years at 4% probability*), probably *55–180 years* (*68% probability*). The construction of the inner south cross-dyke and the outer Stepleton outwork is securely

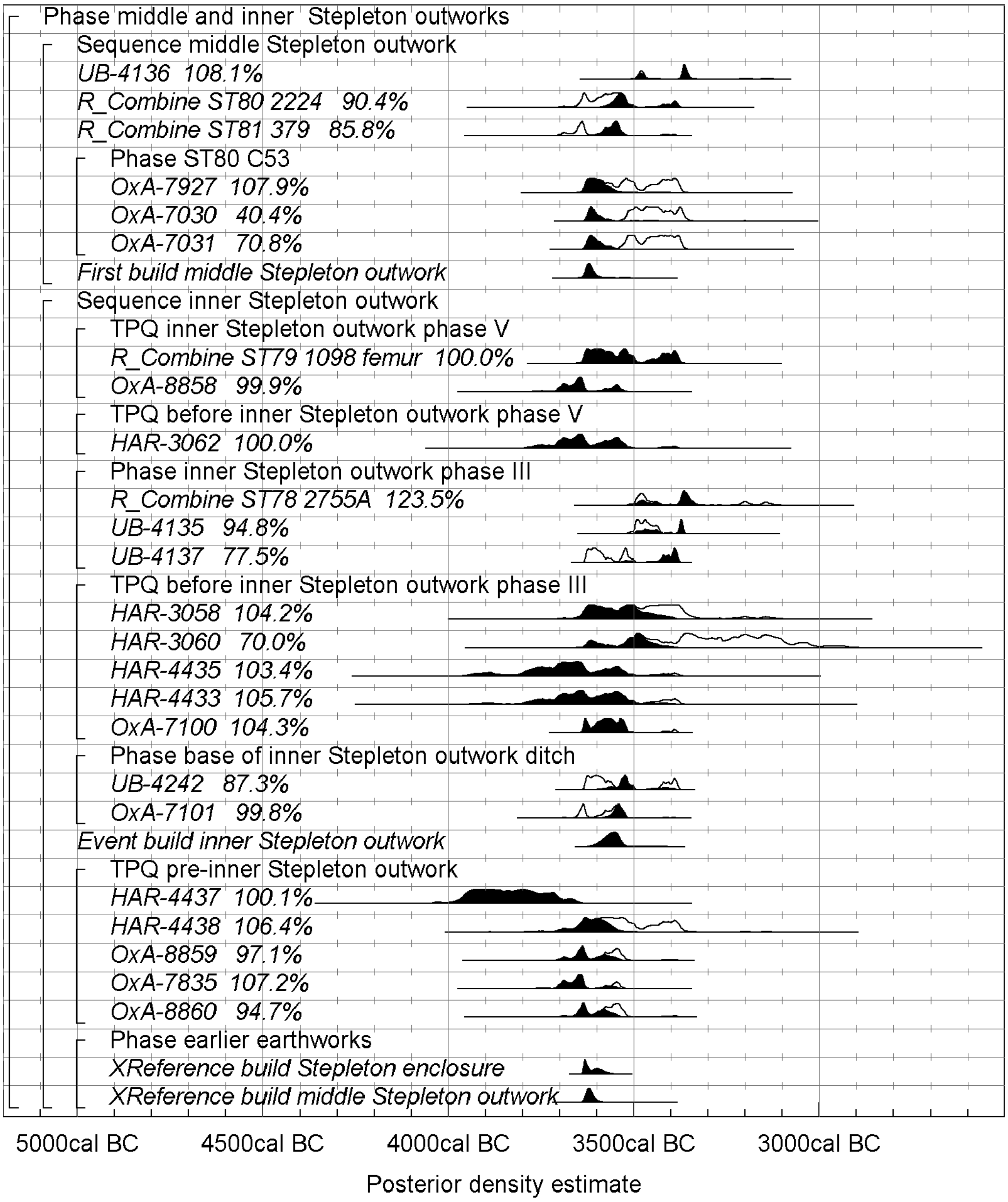


Fig. 4.12. Hambledon Hill. Probability distributions of dates from middle and inner outworks on the Stepleton spur at Hambledon Hill. The format is identical to that of Fig. 4.5. The overall structure of this model is shown in Fig. 4.7, and its other components in Figs 4.8–11 and 4.13.

dated to this period. Although the outer outwork has only one measurement, it is on an articulated human skeleton (a young man by killed by arrowshot; Fig. 4.11: *UB-4243*) which must be primary. The death of this young man, immediately after the construction of the outer outwork, was previously related to the shooting of a second young man found prone in the chalk rubble filling the inner Stepleton outwork ditch (Fig. 4.3: bottom; Fig. 4.12: *ST78 2755A*; Bayliss *et al.* 2008a). The new calibration, however, makes this correlation improbable, since *UB-4243* appears to be earlier than *ST78 2755A* (*78% probable*).

Also in period 3, charred material was put into small pits cut into the largely silted Stepleton enclosure ditch (Fig. 4.3: section B; Fig. 4.11: *OxA-7048–50*). A rich, midden-like deposit of cultural material overlying these (phase VI: *OxA-7926, -7844*) may also fall in period 3. It is possible that the Stepleton enclosure went out of use shortly after period 3 (Fig. 4.11; *end Stepleton enclosure*; Table 4.3), although the dearth of samples from the latest deposits prompts caution on this point.

Period 3 spanned *30–235 years* (*95% probability*; Fig. 4.16: *duration period 3*) or *85–200 years* (*68% probability*), requiring 8500 worker days (Mercer 2008b).

Period 4

After a further interval of *25–165 years* (*95% probability*; Fig. 4.15: *last 3/first 4*), or *35–110 years* (*68% probability*), the last perceptible Neolithic modifications to the complex were made: the outer of the two outworks linking the

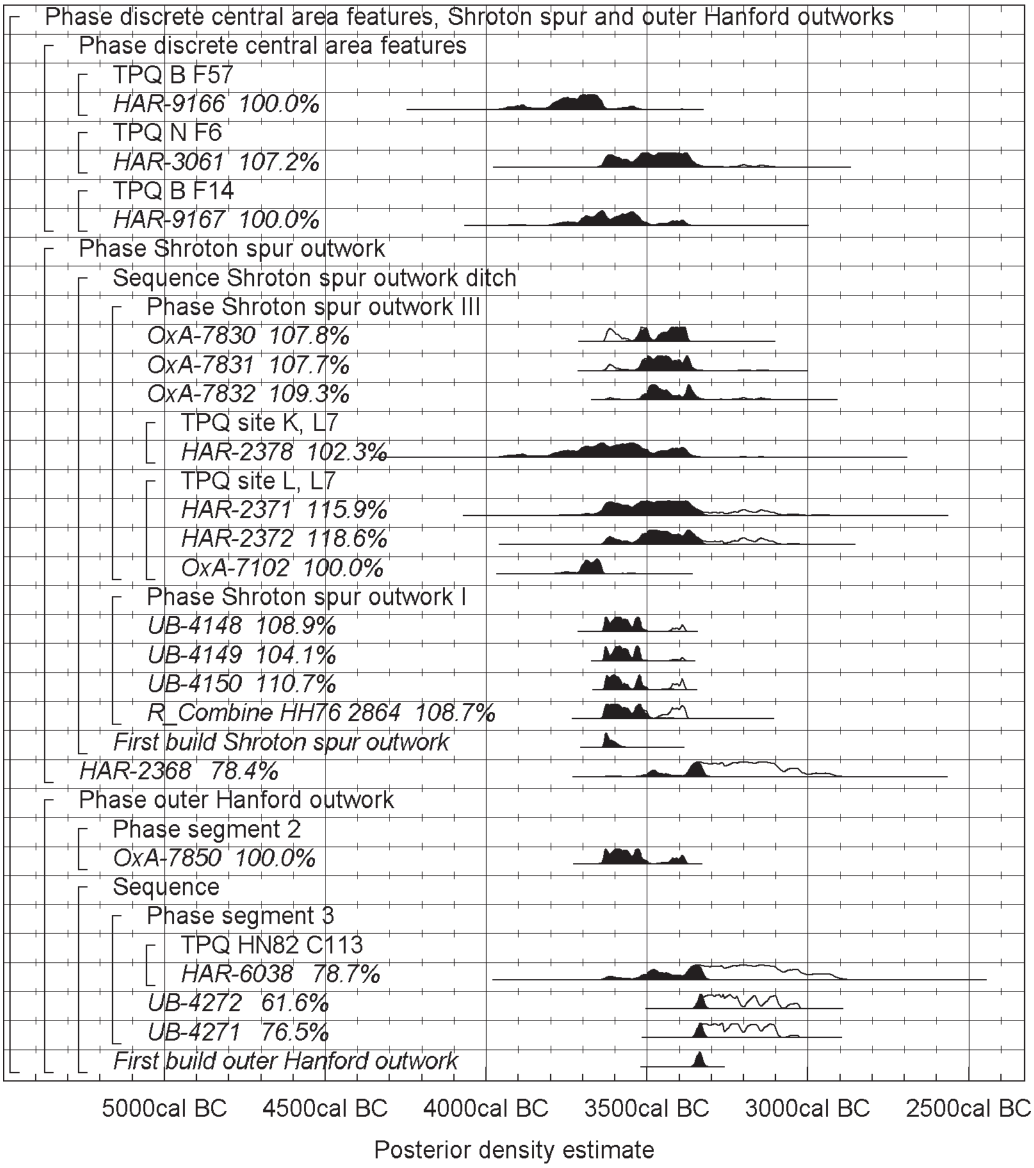


Fig. 4.13. Hambledon Hill. Probability distributions of dates from outworks on the Shroton and Hanford spurs and from discrete features in the central area of the hill. The format is identical to that of Fig. 4.5. The overall structure of this model is shown in Fig. 4.7, and its other components in Figs 4.8–12.

Hanford and Stepleton spurs, the western outwork, perhaps the outer cross-dykes, and perhaps the rebuilding of the Shroton spur gateway. The period is again distinct, dating to the second half of the 34th century cal BC, but only the estimated date for segment 3 of the outer Hanford outwork (Fig. 4.13: *build outer Hanford outwork*) is based on more than a single measurement. The western outwork may have been constructed during this period for two reasons. The distribution shown in Fig. 4.10 provides a *terminus post quem* for construction, and the earthwork itself seems to have been built when the period 3 inner south cross-dyke was already standing, since it bows around it. The outer east cross-dyke is placed here on the evidence of a single measurement (Fig. 4.10: *UB-4267*), which may relate to an extension of a segment rather than to its original construction. The undated outer south cross-dyke is placed here by analogy with it. A possible rebuilding of the Shroton spur outwork gateway (Fig. 4.13: *HAR-2368*) may have been part of larger works represented by an incomplete and undated outer bank and ditch. A child burial cut into the silted main enclosure ditch is securely in period 4 (Fig. 4.9: *HH76 3046*), as is the apparent insertion of articulated cattle bone into the adjoining segment (*UB-4269*). There is little evidence for activity in this period on the Stepleton spur, although this may be in part an effect of a lack of articulated bone samples from the otherwise rich upper fills of the Stepleton enclosure ditch. These final modifications to the complex appear to have been made in a single generation, over a period of *1–25 years* (*95% probability*; Fig. 4.16: *duration period 4*) or *1–15 years* (*68% probability*). They required over a third of the total labour input of the whole process, totalling 16,690 worker days (Mercer 2008b).

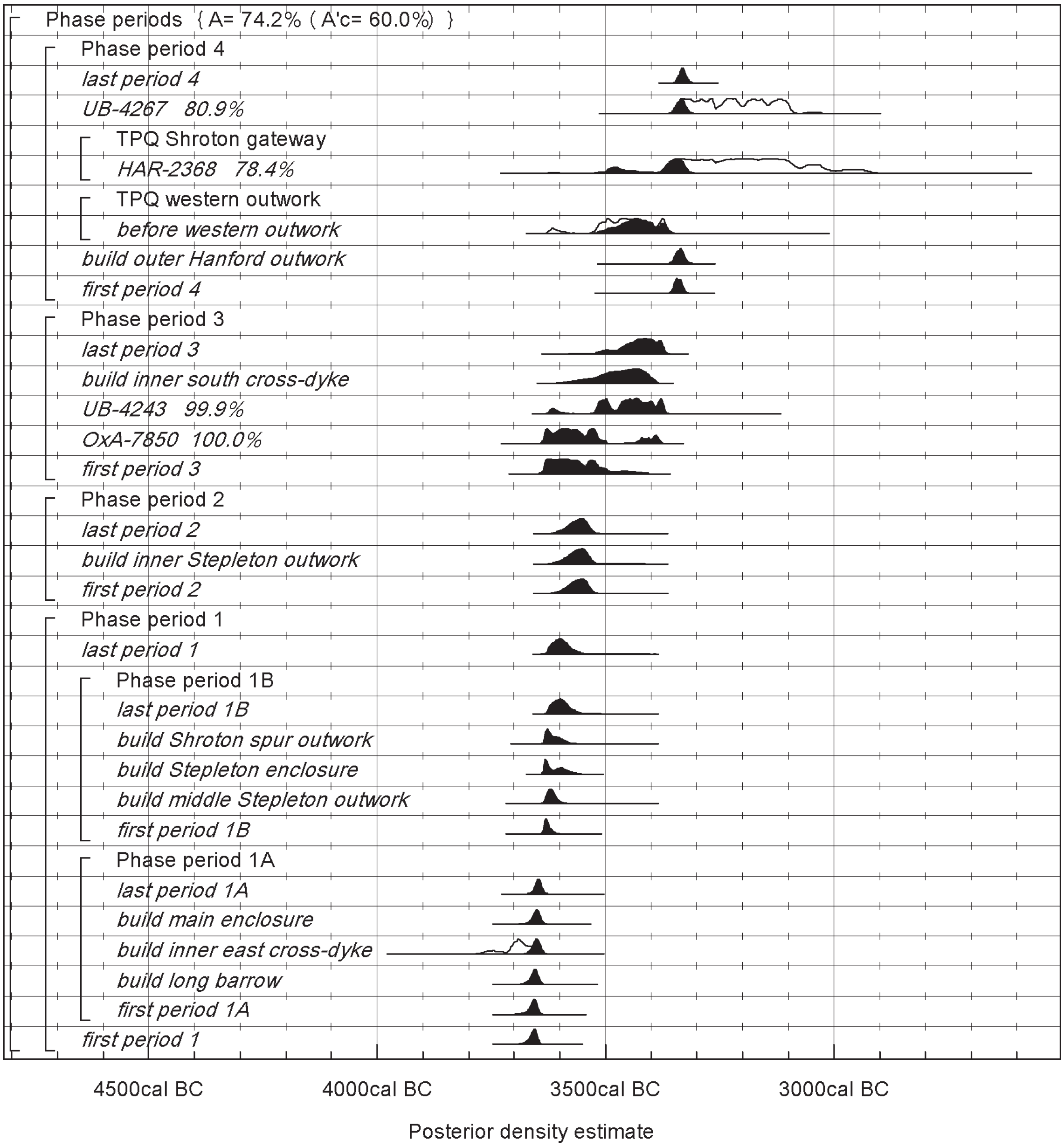


Fig. 4.14. Hambledon Hill. Posterior density estimates for the construction of the Neolithic earthworks and for the periodisation of the complex, derived from the model shown in Figs 4.7–13.

Duration of activity and processes

The model outlined suggests that early Neolithic activity on the hill began in *3685–3640 cal BC* (*95% probability*; Fig. 4.7: *start Hambledon*), probably in the *3660s or 3650s cal BC* (*68% probability*) and ended in *3345–3305 cal BC* (*95% probability*; Fig. 4.7: *end Hambledon*), probably in *3335–3315 cal BC* (*68% probability*). This period of use lasted for *between 310–370 years* (*95% probability*; Fig. 4.16: *use Hambledon*), probably for *between 320–350 years* (*68% probability*).

The model also estimates the dates at which early Neolithic activity ceased in the two enclosures, and hence the period of use of each. The main enclosure was built in *3675–3630 cal BC* (*95% probability*; Fig. 4.7: *build main enclosure*), probably in the *3650s or 3640s cal BC* (*68% probability*). The main enclosure went out of use in *3355–3310 cal BC* (*95% probability*; Fig. 4.7: *end main enclosure*), probably in *3345–3325 cal BC* (*68% probability*), giving a span of *290–350 years* (*95% probability*; Fig. 4.16: *use main enclosure*), probably of *300–335 years* (*68% probability*). These estimates suggest that the main enclosure remained in use throughout the earlier Neolithic frequentation of the hill.

The Stepleton enclosure was built in *3640–3565 cal BC* (*95% probability*; Fig. 4.11: *build Stepleton enclosure*) probably in *3640–3615 cal BC* (*42% probability*) or in *3610–3585 cal BC (26% probability*). It went out of use in *3425–3375 cal BC* (*95% probability*; Fig. 4.11: *end Stepleton enclosure*), probably in *3410–3375 cal BC* (*68% probability*). Overall the Stepleton enclosure was in use for *165–255 years (95% probability*; Fig. 4.16: *use Stepleton enclosure*),

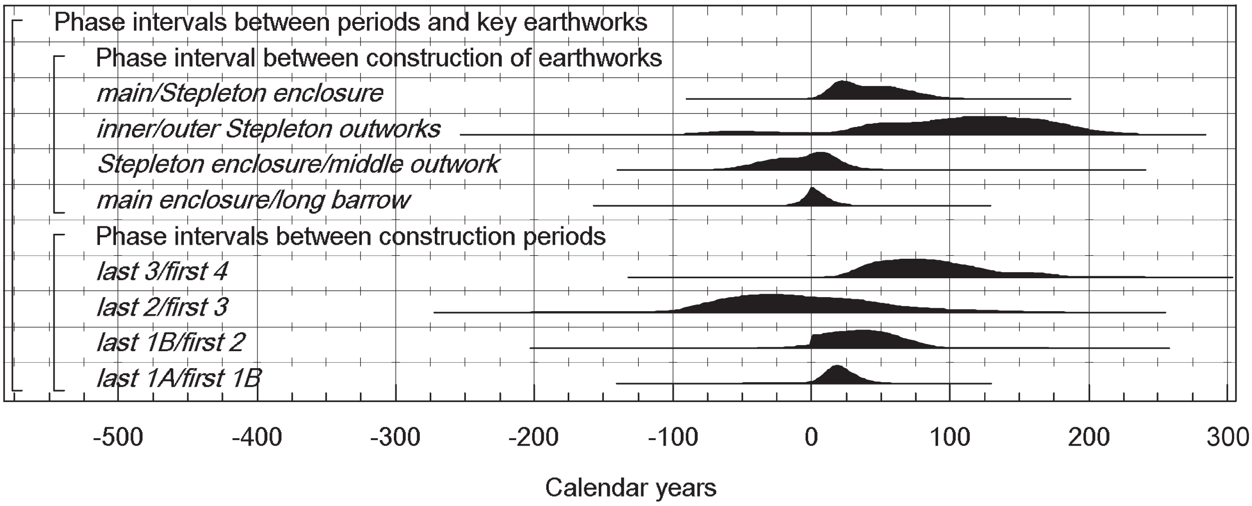


Fig. 4.15. Hambledon Hill. Probability distributions of the number of years between periods of earthwork construction and key earthworks, derived from the model shown in Figs 4.7–13.

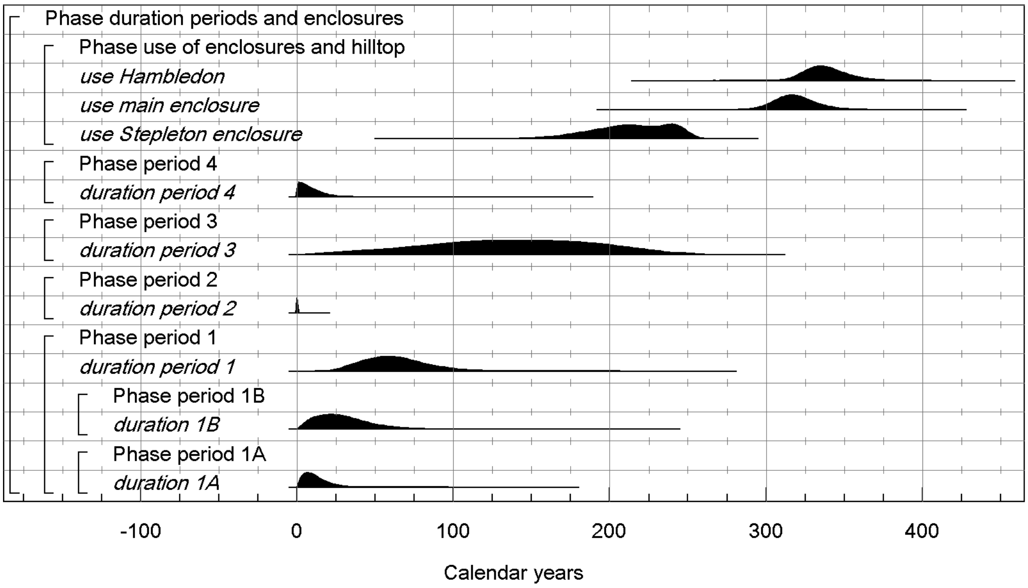


Fig. 4.16. Hambledon Hill. Probability distributions of the duration of the periods and of the number of years during which the causewayed enclosures and the monument complex were in primary use (derived from the model shown in Figs 4.7–13).

probably for *195–250 years (68% probability*). It is almost certain (more than 99% probable) that the main enclosure was constructed before the Stepleton enclosure (Table 4.4). The Stepleton enclosure was built *5–90 years* after it (*95% probability*; Fig. 4.15: *main/Stepleton enclosure*), probably *10–60 years* after it *(68% probability*).

Sensitivity analyses

An alternative model for the chronology of Hambledon Hill is discussed by Bayliss *et al.* (2008a). A limited number of additional models have been constructed as part of this project to investigate the later fourth millennium use of the hill, in particular in relation to the construction of the Dorset cursus and the concomitant upsurge of activity in Cranborne Chase.

The identification, at a late stage in analysis, of a recut through the phase III fills of the east end of segment 5 of the inner Stepleton outwork indicated that the sample for UB-4135 may have come from later in the sequence than its place in the main model presented here (Fig. 4.12). If this interpretation is included in the model the estimated date for the building of the inner Stepleton outwork does not change.

Visual inspection of Fig. 4.9 might suggest that the continuity of use of the main enclosure into the last quarter of the 34th century cal BC critically depends on the late samples postulated as coming from recuts post-dating the phase VI slots in segments 17 and 18 (Fig. 4.9: *HH76 3046*, *UB-4269*). If this activity is unrelated to the main use of the enclosure and these measurements are excluded, however, the model produces identical estimates for the dates of the construction and disuse of the enclosure and for the duration of activity within it.

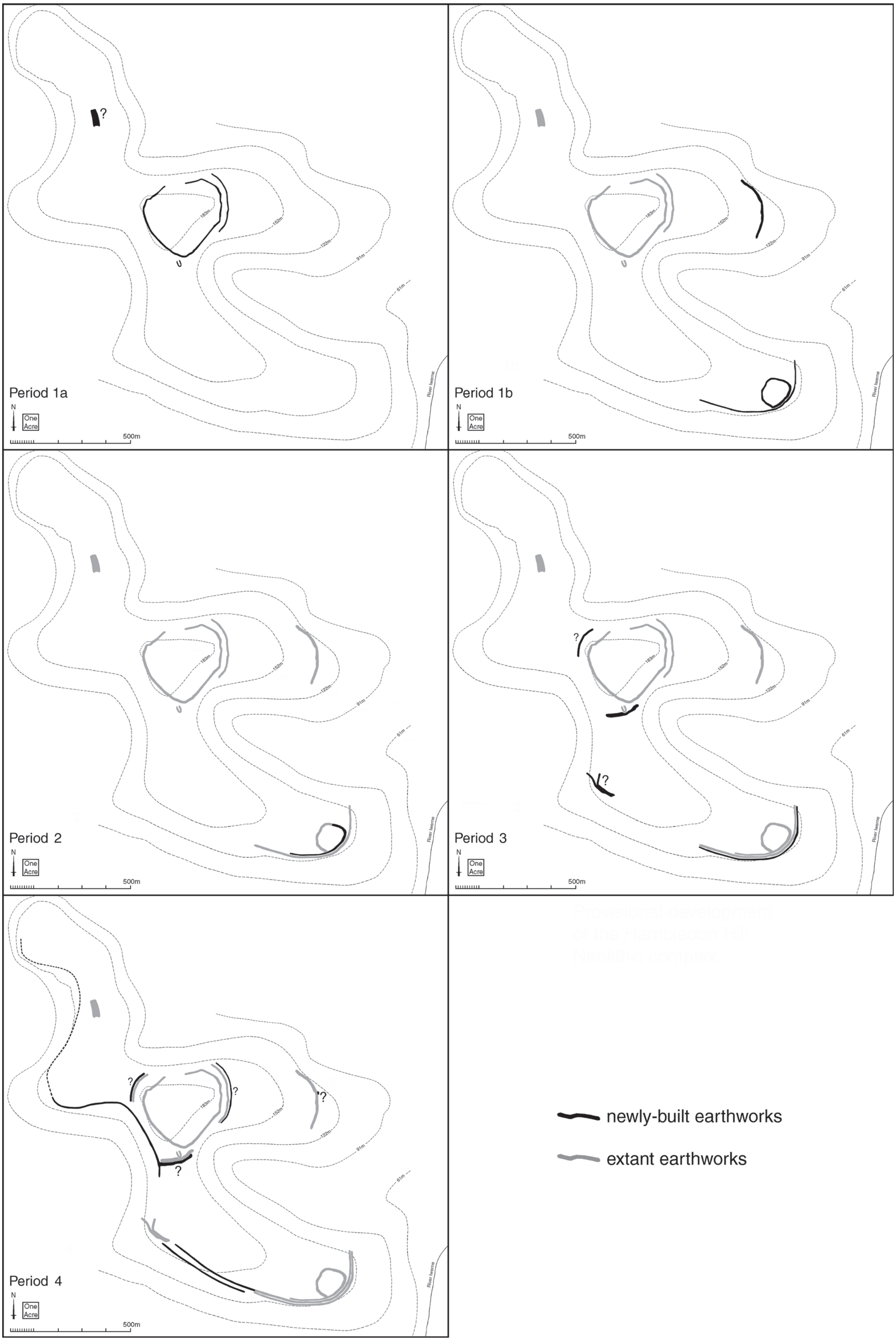


Fig. 4.17. Hambledon Hill. Phase plan. After Mercer and Healy (2008, fig. 1.9).

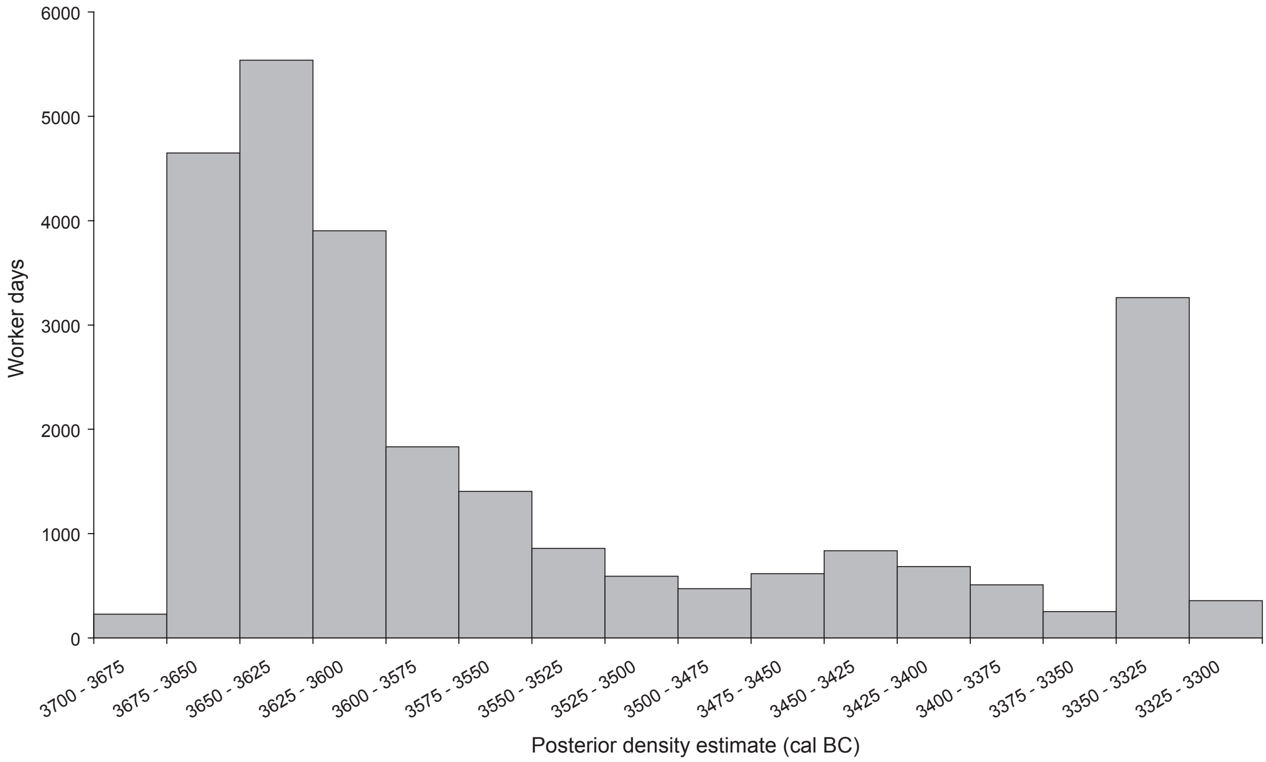


Fig. 4.18. Hambledon Hill. Histogram of estimated number of worker days required to construct the dated earthworks (following Mercer 2008b) by quarter centuries. For each earthwork the probability that it was constructed in each 25-year block has been calculated from the posterior density estimate for its construction (derived from the model shown in Figs 4.7–13), and the worker day estimate for the earthwork apportioned correspondingly.

Period 4, with a shift of constructional emphasis from the east to the west side of the hill and to the building of earthworks across steep slopes rather than on gently sloping spurs, has a different aspect from the preceding phases of activity on the hill, and its relation to them may be questioned. Is period 4 really part of the main Neolithic use of the Hambledon complex rather than a distinct, later, episode?

To investigate this possibility, the measurements from segment 3 of the outer Hanford outwork (Fig. 4.13: *UB-4271–2* and *HAR-6038*), the putative rebuilding of the Shroton spur gateway (Fig. 4.13: *HAR-2368*) and a possible extension to the outer east cross-dyke (Fig. 4.10*: UB-4267*) were excluded. In this case, our estimate for the end of the main Neolithic use of Hambledon Hill shifts by a couple of decades, to *3365–3330 cal BC* (*95% probability;* distribution not shown), probably in the *3350s or 3340s cal BC* (*68% probability*). Since, even when the latest elements in the sequence are deliberately excluded, the main Neolithic activity on the hill still continues well into the 34th century, it seems likely that the period 4 earthworks do indeed form part of the main use of the Hambledon complex. The main model, then, defined in Figs 4.7–13, is to be preferred.

Implications for the site

The pine charcoal dated to the eighth millennium cal BC recovered from two widely spaced, posthole-like, features on the hill is likely to have been anthropogenic. If it had survived from a natural fire in the Boreal forest there would be pine charcoal in many Neolithic contexts, including those close to the features from which the samples came, and this is not the case. Yet there are at most two possibly Mesolithic cores, out of an excavated collection of some 89,000 pieces of struck flint (Saville 2008), in contrast to an abundance of lithics of the period on the Clay-with-Flints in Cranborne Chase to the east (Barrett *et al*. 1991, 29–30; M. Green 2000, 20–8). The hill seems to have been a vantage point rather than a living place at this time.

Artefacts of the early third millennium are as scarce on the hill as those of the Mesolithic, and the site seems to have been abandoned at this time. Yet one of the largest animal bone deposits, a heap including the remains of two adult cattle, one caprine and some bones of infantile cattle and of pig (Legge 2008), is dated to 2930–2700 cal BC (95% confidence; Table 4.2: OxA-8893). This slaughter could have fed large numbers of people. Just as in the eighth millennium, the absence of artefacts does not mean the absence of activity.

The identification of a burial and a possible corn dryer both dating to the mid- to late second millennium cal BC on the Stepleton spur has prompted a re-examination of the evidence for occupation in this period with the conclusion that there was a settlement on the Stepleton spur, perhaps related to a burnt mound in Everley Water Meadow in the

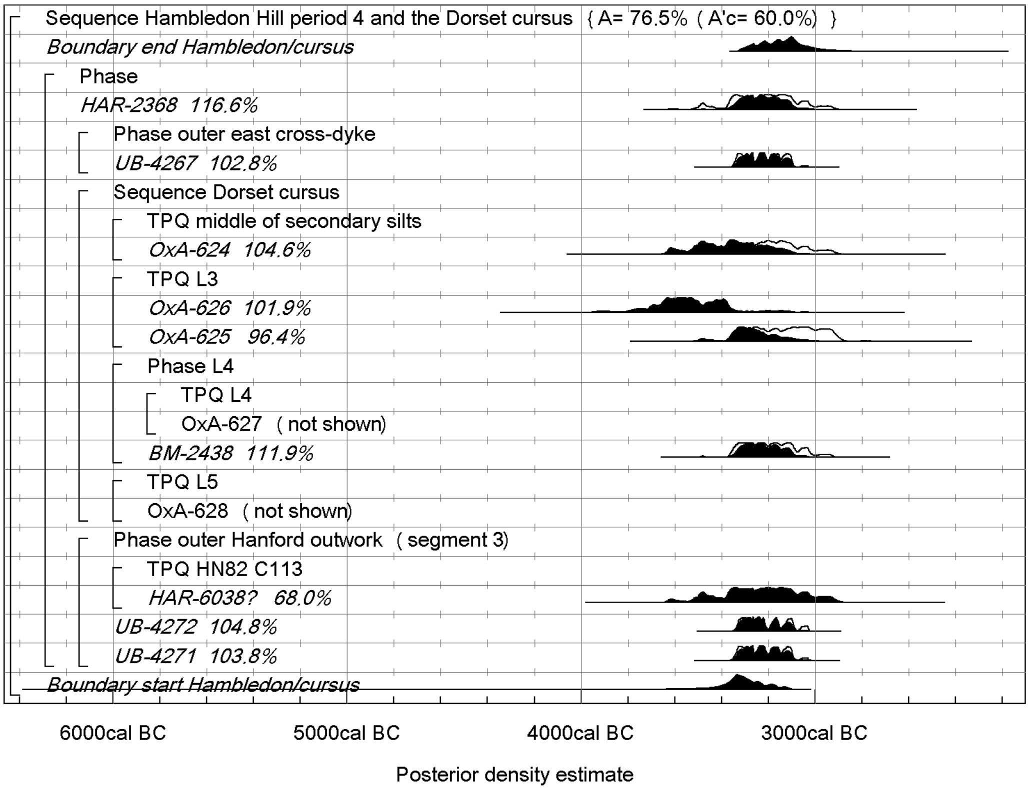


Fig. 4.19. Probability distributions of dates from the period 4 earthworks on Hambledon Hill and the Dorset cursus, interpreting these constructions as part of a linked complex. The format is the same as for Fig. 4.5. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Iwerne valley below (Table 4.2: HAR-6529–31) and to a vestigial 'Celtic' field system detected by Rog Palmer on the spur to the north of the enclosure (Palmer and Oswald 2008). Contributory evidence includes a few sherds in Bronze Age fabrics in some of the many, largely undated, postholes within and around the Stepleton enclosure, as well as considerable quantities of Bronze Age pottery and calcined flint in the ploughsoils which fill the tops of the ditches on the spur, especially the massive inner Stepleton outwork (Mercer and Healy 2008). If the structures represented by most of the postholes were indeed built in the second millennium, then the case for substantial fourth millennium settlement on the spur (Mercer 1988, 100–1) is weakened and its use appears ceremonial, like that of the main enclosure.

In the outer Hanford outwork, there is a discrepancy between an articulating sample from the initial silts of one segment (Fig. 4.13: *OxA-7850*) and the more recent dates of two articulated samples from the base of an adjacent segment to the south (Fig. 4.13: *UB-4271–2*; T'=46.9; T'(5%)=6.0; ν=2), the more recent dates themselves being consistent with a pre-existing date on unidentified bulk charcoal from the base of the same segment (Fig. 4.13: *HAR-6038*; T'=0.4; T'(5%)=6.0; ν=2). If the more southerly segment was indeed later than the more northerly one this would conform to an argument from earthwork survey that the central segments of the Hanford outworks, which would include the source of *OxA-7850*, were already present when more regular, linear outworks, the outer one ending in the segment which was the source of *UB-4271–2* and *HAR-6038*, were built around the south-west side of the hill (Palmer and Oswald 2008). This is the option adopted in Table 4.1 and Fig. 4.14.

The use-life of the complex reduces the numbers of finds that would have been in use at any one time. If the density of the excavated assemblage of finds is projected, with all the attendant uncertainties, on to the totality of the uninvestigated Neolithic archaeology, and spread over the *310–370 years* (*95% probability*; Fig. 4.16: *use Hambledon*) for which the complex was in use, the numbers of finds per year become quite low, of the order of some bones from one or two people, 440–600 pot sherds, 1030–1370 pieces of struck flint, and the remains of one or two cows – the equivalent of the contents of one or two of the richer pits of the period (Mercer and Healy 2008, table 11.4). This estimate is based on material from all contexts in all earthworks and hence differs from those presented in Tables 14.3–4 of this volume, which are based only material from early Neolithic contexts in the better-dated earthworks. It is the cattle which suggest that in at least some episodes there were large numbers of people present. One of the young cows which dominate the faunal remains would have provided some 300 kg of meat, offal and fat, and some of the phase VI slots in the upper ditch fills of the central area, which seem to have been cut and filled in single events, contained the remains of two or three such

animals (Legge 2008). This points to gatherings of hundreds of people – many hundreds if several such events took place simultaneously. The abiding impression is of a site which was little used, and when it was used, was occupied for short periods, at specific seasons, for short-term *ad hoc* activities involving feasting and deposition.

A major development is the demonstration that construction of new earthworks and the modification of existing ones were spread over the same period. At one level, we can see them as episodic. From this it follows that just as the timescale reduces the assemblage deposited at any one time, so it lessens the levels of resources and social co-ordination needed to build what had been seen as a single outwork system, conceived and built as an entity and encompassing the entire hill (Mercer 1988, 101–4). Mercer (2008b) now estimates that the main enclosure could have been built in two years by a workforce of 100 working for two months in late summer/early autumn, and almost any other individual earthwork in one year on the same basis, the whole seen as 'not a major undertaking for a population of 1000 (100 families) who thought that it was important enough'. Combined with indications that people may have come to the hill from 40 km or more away (Healy 2004, 30–2), this could be consistent with a fairly thinly scattered population. At another level, we can see from Figs 4.17–18 that construction was not evenly distributed through the site periods. When the overall timespan is divided into 25-year blocks, we have calculated, using the worker day estimates already given above for each of the dated features of the complex, that the majority of the initial labour input (54%) was achieved in the 75 years between 3675 and 3600 cal BC – in periods 1a and 1b. Thereafter, construction continued episodically across the generations of periods 2 and 3, down to 3350 cal BC, but at a much reduced level (Fig. 4.18).

A period of renewed earthwork construction is visible in the third quarter of the 34th century cal BC (3350–3325 cal BC; Figs 4.17–18). This upsurge of activity may have been even more marked than is apparent in this figure, since the western outwork is not included because its dating rests only on a *terminus post quem*. If its length is correctly estimated (Table 4.1), this outwork would have consumed even more resources than the main enclosure, spectacularly so if one or both of the outworks linking the Stepleton and Hanford spurs were built at the same time, as they could have been within the limits of the available dating evidence (Fig. 4.16). This massive undertaking, coming towards the end of the sequence of construction, emphasises that, while both enclosures and at least one long barrow were built in period 1, it was outworks which continued to be built in the following centuries, although the enclosures continued to be re-worked. Perhaps the need to impress and defend lasted beyond the impetus to enclose.

These period 4 outworks have distinctive characteristics beyond their size. Their predecessors were built on gently-sloping spur tips, incorporated gateways and, except for the Hanford spurwork, were east- or south-facing. These latest outworks extended for greater distances across steeper slopes and presented an almost continuous west-facing façade (Fig. 4.17). It may be relevant here that, through most of its use-life, the complex seems to have had strong connections with the west, which may even have been the area from which many of its frequenters came (Healy 2004; Mercer and Healy 2008, chapter 11). The outworks of periods 1–3 were almost all built to be visible from the east, with which the complex may have had relatively few links, leaving the hill open to the west, probably an important part of its catchment. The construction in period 4 of outworks of a different kind and orientation could suggest that the complex was then appropriated to the expanding and developing ceremonial focus then emerging in Cranborne Chase to the east, which is discussed further below.

The question thus arises as to whether the period 4 constructions should be seen as a final flourish of the enclosure tradition on Hambledon Hill, or part of new beginnings and new trends which had their major focus elsewhere. In a sense, this is an artificial distinction, since the period 4 earthworks could represent both (just as, say, the blocking of the West Kennet long barrow can be seen as both protective enhancement and definitive closing). In another perspective, the earthworks in question share, locally, much in common with the Dorset cursus, in terms of linearity and scarcity of deposition. We have therefore also modelled the period 4 earthworks on Hambledon Hill together with the (admittedly very uncertainly dated) Dorset cursus, as a separate phase of activity, which can be estimated to have started in *3510–3105 cal BC* (*95% probability*; Fig. 4.19: *start Hambledon/cursus*) or more probably in *3385–3220 cal BC* (*68% probability*). This period of monument construction ended in *3325–2930 cal BC* (*95% probability*; Fig. 4.19: *end Hambledon/cursus*), probably in *3275–3255 cal BC* (*3% probability*) or *3240–3055 cal BC* (*65% probability*). In this scenario, it is probable that there was a short gap between the end of the main Neolithic use of Hambledon Hill and the construction of the cursus (*72% probable*). The duration of the gap cannot be calculated robustly given the paucity of existing data. In the spirit of this model, both the Dorset cursus and the west-facing outworks at Hambledon Hill could be seen as part of one grand, linked design, truly monumental in both conception and spatial scale. Chris Tilley (1994, 200) has already suggested that people walked south-west down the cursus towards the 'great death island' of Hambledon Hill. This connection could hold good in our model, but the chronology has changed, since unlike in the scenario proposed by Tilley, the active deposition of human remains both at Hambledon and perhaps in local long barrows had taken place considerably earlier. Hambledon Hill could have become the 'island of the past' in this putative new worldview.

Finally, three successive violent events on the Stepleton spur in periods 2 and 3 may have been preceded by another in period 1 on the Shroton spur, where some of the posts in the bank area were burnt and charcoal and other burnt material had entered the ditch from the inner edge along a distance of as much as 140 m (assuming that burning

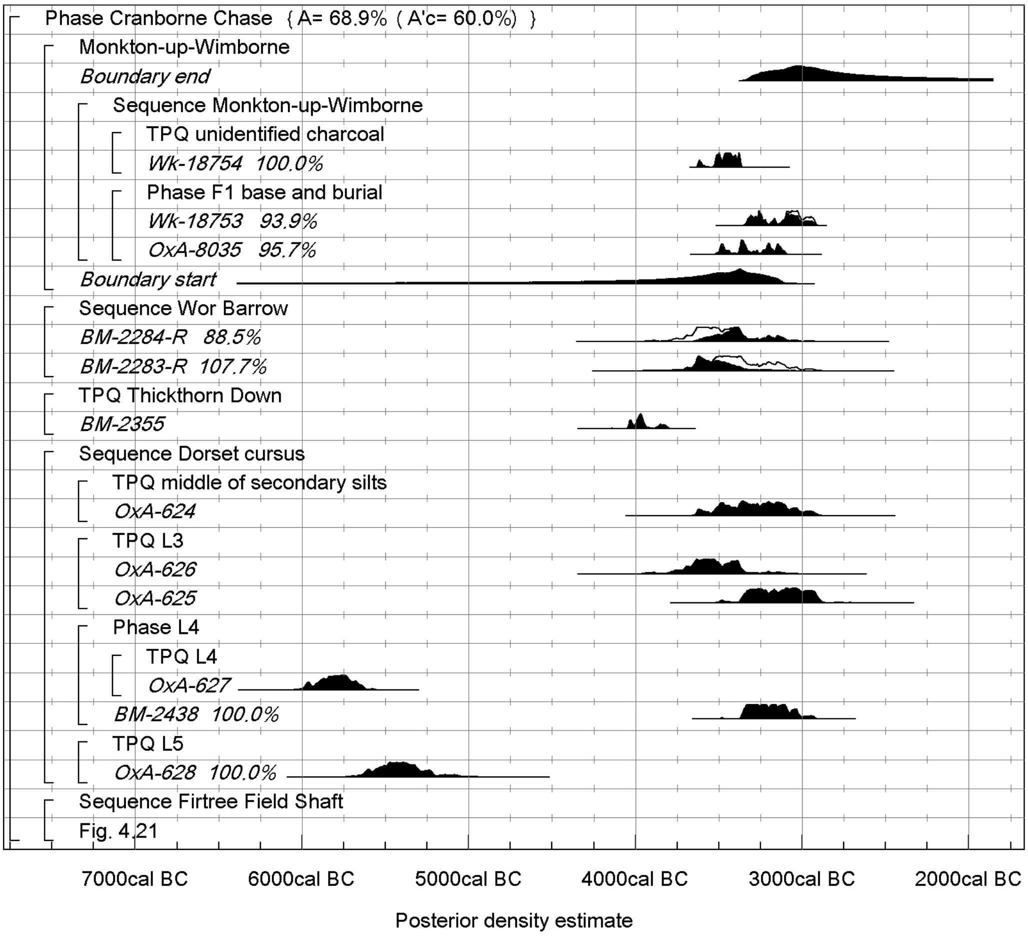


Fig. 4.20. Cranborne Chase. Probability distributions of dates. The format is the same as for Fig. 4.5. The component section for the Fir Tree Field shaft is shown in Fig. 4.21. The large square brackets down the left-hand side of Figs 4.20–1, along with the OxCal keywords, define the overall model exactly.

was continuous between separate excavations). Here too, a rampart may have burnt and the ash and charcoal silted into the ditch. It may be relevant that the Shroton and Stepleton spurs provide the easiest approaches to the hill (Fig. 4.2). A number of factors could have been at work. The gathering of otherwise scattered populations could have resulted in unusually big concentrations of people. That might have been a fissile situation, and tensions and fights could have broken out if aggregation were maintained for any length of time. The scale of the Hambledon complex and, by implication, its importance and the numbers of people which it could accommodate, could also have made its users particularly conspicuous and vulnerable. Jealousies could have provided the motive for hostilities on a scale otherwise altogether unusual, and the situation could have prompted the construction of defences. But this does not make its sole function defensive. It rather encapsulated numerous aspects of contemporary life of which conflict, on whatever scale, was one. And it is striking that given the timescales now estimated there were not more frequent violent episodes. It is further intriguing to note that on the basis of the excavations so far, no evidence of violent encounter has been found in period 4, but whether this further reflects the change in character discussed above or is simply a product of the relative lack of excavation of this part of the complex, is an open question, and a matter for future research.

Implications for the local setting

Radiocarbon dates from Cranborne Chase are listed in Table 4.6 and shown in Figs 4.20–1. The Chase is rich in Mesolithic material, including typologically late industries characterised by geometric microliths (J. Arnold *et al*. 1988). There are major concentrations on the Clay-with-Flints in the north of the area, with further sites clustered around the headwaters of the river Allen (Barrett *et al*. 1991, 29–30; M. Green, 2000, 20–8). In this second area there is some chronology for the later aspects of this activity. Finds from a section across the Dorset cursus in Chalk Pit Field, the site of a late Mesolithic industry (M. Green 2000, fig. 16), included two animal bone fragments dated to the sixth millennium cal BC (Fig. 4.20: *OxA-627–8*). Predominantly woodland molluscs from the lower silts of the cursus ditch may also have been redeposited, especially as equivalent levels in the cursus ditch in Fir Tree Field 600 m to the south-west yielded predominantly grassland molluscs (Entwistle and Bowden 1991, 20–6; M. Allen 2000, 39–40).

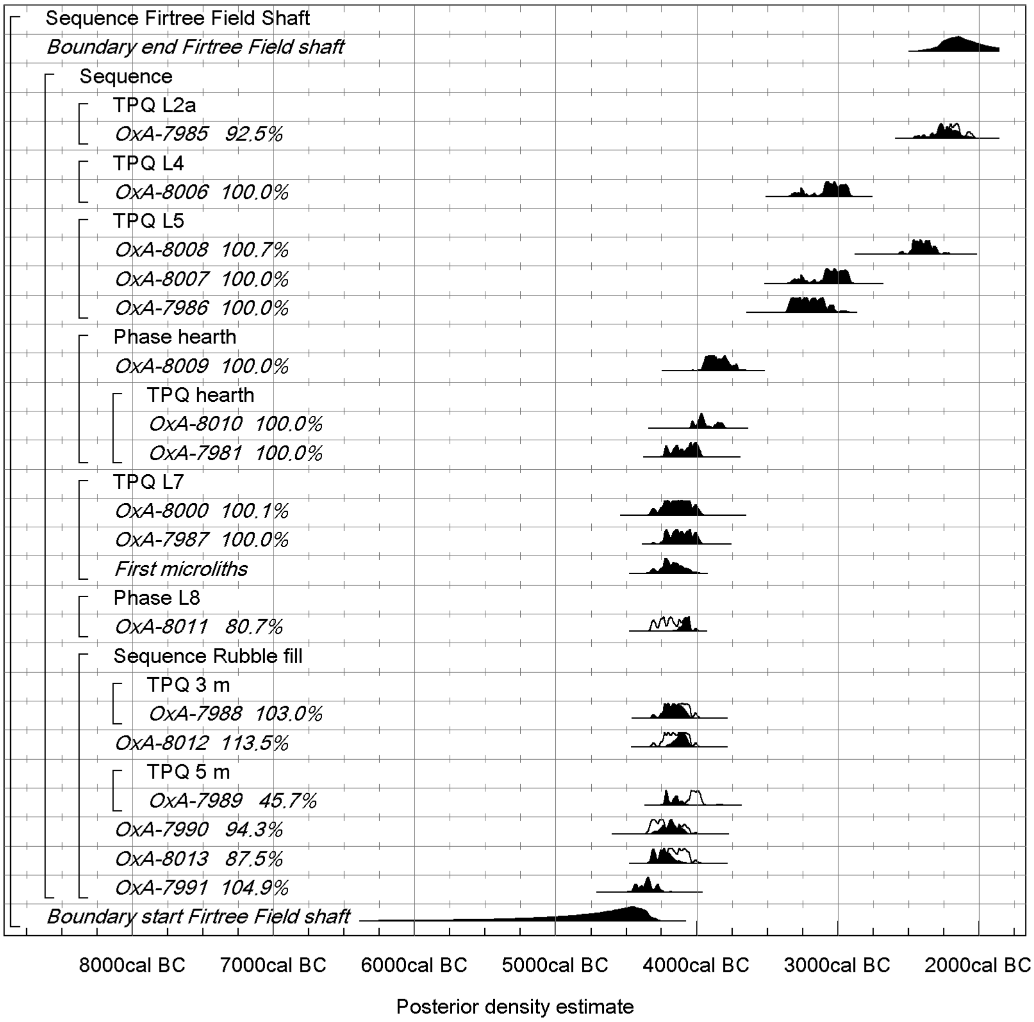


Fig. 4.21. Fir Tree Field shaft. Probability distributions of dates (OxA-8907 is excluded from the model). The format is the same as for Fig. 4.5. The overall structure of this model is shown in Fig. 4.20.

Close to the cursus here, a doline over 13 m deep, now known as the Fir Tree Field shaft, preserved a remarkable sequence of deposits running from the mid-fifth to the late third millennium cal BC (Allen and Green 1998; M. Green 2000, 27–8; M. Allen 2000, 40–3; French *et al.* 2007, 76–8). Its lower part was filled with chalk rubble. This accumulation would have been entirely natural and most of its contents could have entered it by natural means. The lowest soil lens within it contained a Boreal environmental assemblage, pine charcoal from which is dated to the seventh millennium cal BC (Table 4.6: OxA-8907). This measurement is not included in the model. The overlying samples from the chalk rubble all dated from the fifth millennium cal BC, most spectacularly two articulated roe deer skeletons, one nearly 2 m above the other, which seem to have fallen into the shaft (French *et al.* 2007, fig. A4.8). These animals would have died where they fell, and their dates (Fig. 4.21: *OxA-7991, -7990*) lie respectively in the third and fourth quarters of the fifth millennium cal BC. Charcoal, struck flint and a cut-marked deer metatarsal, however, testify to a human presence. Two dates on short-life charcoal, one from between the two skeletons and the other from above the upper one (Fig. 4.21: *OxA-8013, -8012*) are in good agreement with the stratigraphic sequence. Two disarticulated animal bone samples (Fig. 4.21: *OxA-7989, -7988*) are treated as *termini post quos*. Throughout the rubble fills, Mollusca indicated open conditions, probably of open dry long grassland with some shrubs, possibly of park woodland (French *et al.* 2007, 305).

The earthy fills of the weathering cone at the top of the shaft contained far more cultural material. Locally shady conditions at their base had given way to bare earth and short grassland by the time of the burial of seven microliths, most of them rod forms, tightly clustered, as if they had been hafted when they entered the shaft (M. Green 2000, 28; French *et al.* 2007, 282–5, 306). If so, their deposition would have been close in time to the last use of the weapon of which they formed a part. Within the shaft, this level is estimated to date to *4330–4285 cal BC* (*6% probability*; Fig. 4.21: *microliths*) or *4270–4035 cal BC* (*89% probability*), probably to *4240–4100 cal BC* (*68% probability*). Further rod microliths occur in a surface scatter 300 m to the north-west, suggesting possibly contemporary activity (M. Green 2000, 28).

Table 4.6. Fifth and fourth millennium cal BC radiocarbon dates from Cranborne Chase, Dorset. Posterior density estimates derive from the model defined in Figs 4.20–1.

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$(‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Monkton-up-Wimborne								
OxA-8035	MUW97 F23 (C)	Human. L femur of articulated adult female	Burial of a woman and three children in grave cut into floor of large pit in which there was also a deep central shaft and a chalk platform, the whole surrounded by a ring of smaller pits (Green 2000, 77–84; French *et al*. 2007, 112–21)	4585±50	−21.2		3500–3100	*3505–3425* (*15%*) or *3385–3260* (*35%*) or *3255–3095* (*45%*)
Wk-18753	S 150	Charred hazel twigs	Surface of base of F1, under platform (French *et al*. 2007, 118)	4427±42	−22.8±0.2		3340–2910	*3335–3210* (*37%*) or *3190–3150* (*6%*) or *3130–2925* (*52%*)
Wk-18754	S 28	Unidentified charcoal	Shaft, layer 10. Near top of shaft dug after some silt had accumulated on floor of F1 (French *et al*. 2007, 118–20)	4674±37	−21.3±0.2		3630–3360	*3630–3595* (*6%*) or *3525–3360* (*89%*)
Dorset Cursus, Chalkpit Field								
OxA-628	Dorset E	Cattle. Bone	L5. Primary silts (Barrett *et al*. 1991, fig. 2.13: 1984 sections)	6460±140			5640–5070	*5645–5200* (*91%*) or *5175–5070* (*4%*)
BM-2438	3820/4	Red deer. Antler pick	L4. Partially stabilised surface on top of primary ditch silts, sealed by secondary silts containing Mortlake and Fengate Ware sherds. Marked 'X' on published section (Barrett *et al*. 1991, fig. 2.13: upper 1984 section)	4490±60	−21.1		3370–2920	*3365–3005* (*94%*) or *2980–2955* (*1%*)
OxA-627	Dorset D	Cattle. Bone	From the same context as BM-2438	6900±100			6000–5620	*5985–5630*
OxA-625	Dorset B	Cattle. Bone	L3. Lower part of secondary silts (Barrett *et al*. 1991, fig. 2.13: 1984 sections)	4440±100			3490–2880	*3370–2890*
OxA-626	Dorset C	Cattle. Bone	From the same context as OxA-625	4770±120			3790–3190	*3805–3320* (*92%*) or *3220–3170* (*2%*) or *3165–3115* (*1%*)
OxA-624	Dorset A	Cattle. Bone	Middle of secondary silts, associated with Peterborough Ware	4570±120			3640–2910	*3635–3575* (*4%*) or *3535–3000* (*87%*) or *2995–2925* (*4%*)
Thickthorn Down								
BM-2355	Sample 3	Red deer. Antler 'Sample had been treated with PVA and was cleaned with acetone but there is slight possibility of contamination surviving pretreatment' (Ambers *et al*. 1987, 180)	Surface of buried soil beneath N quadrant of long barrow (Drew and Piggott 1936, 81)	5160±45	−21.0 (estimated)		4050–3800	*4050–3905* (*76%*) or *3880–3800* (*19%*)
Wor Barrow								
BM-2283R	Sample 1	Red deer. Antler base, probably pick	'Depth 11 ft. Bottom of ditch'	4660±130	−21.9		3700–3020	*3775– 3275*

Laboratory Number	**Sample reference**	**Material**	**Context**	**Radiocarbon Age (BP)**	**$\delta^{13}C$ (‰)**	**$\delta^{15}N$(‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
BM-2284R	Sample 2	Red deer. Antler fork	'Depth 10.5 ft. On bottom of ditch'. Probably in lowest silts, rather than on ditch bottom (Barrett and Bradley 1991, 9; Barrett *et al.* 1991, 43)	4740 ± 130	−21.0		3790–3100	*3630–3085* (*94%*) or *3060–3025* (*1%*)
Fir Tree Field Shaft								
OxA-8907	Sample 20	*Pinus* charcoal	Lens 10. Soil lens in chalk rubble infill of shaft, with Boreal environmental assemblage	7530±70	−25.1		6480–6230	
OxA-7991	Sample 19	Roe deer. R radius from articulated skeleton	7 m deep in rubble fill, roe deer 2. Probably a pit-fall victim	5500±55	−23.8	3.9	4460–4250	*4455–4260*
OxA-8013	Sample 18	*Corylus* charcoal	From patch of scattered charcoal fragments 6.50 m deep in rubble fill	5335±50	−24.2		4330–3990	*4335–4140*
OxA-7990	Sample 17	Roe deer. Metatarsal from articulated skeleton	5.2 m deep in rubble fill, roe deer 1. Probably a pit-fall victim	5385±65	−22.4	3.1	4360–4040	*4300–4075*
OxA-7989	Sample 16	Red deer. Disarticulated metatarsal	*c.* 5 m deep in rubble fill. Apart from roe deer 1	5220±50	−20.5	4.4	4230–3950	*4240–4090*
OxA-8012	Sample 15	*Corylus* charcoal	Patch of small charcoal fragment 3.50 m deep in rubble fill	5315±45	−25.2		4330–3990	*4200–4050*
OxA-7988	Sample 14	Red deer. Disarticulated metatarsal with cut-marks	3.05 m deep in rubble fill	5310±45	−21.1	4.6	4320–3990	*4315–4300* (*2%*) or *4260–4055* (*93%*)
OxA-8011	Sample 13	*Corylus* charcoal	L8. Patch of small charcoal fragments within topmost layer of rubble	5355±45	−25.1		4340–4040	*4140–4035* (*89%*) or *4025–3990* (*6%*)
OxA-7987	Sample 12	Red deer. Disarticulated scapula	L7. Near base of silt layer, at same level as group of 7 microliths, 5 of them rods, probably hafted in a single weapon	5275±50	−21.4	3.5	4250–3970	*4240–3975*
OxA-8000	Sample 11	Cattle, ?aurochs. Disarticulated scapula	L7. Silt layer, marked 'scapula' on published section (Allen and Green 1998, fig. 6)	5300±70	−22.6	4.9	4330–3960	*4325–4290* (*4%*) or *4265–3975* (*91%*)
OxA-8010	Sample 10	*Fraxinus* charcoal	L6b. Hearth	5150±45	−23.7		4050–3800	*4045–3905* (*69%*) or *3880–3800* (*26%*)
OxA-8009	Sample 9	Charred *Clematis* roots	L6b. Near hearth	5045±45	−26.3		3970–3700	*3960–3755* (*89%*) or *3745–3710* (*6%*)
OxA-7981	Sample 8	Pig. Disarticulated femur	L6a. Layer with plain Bowl pottery, associated with hearth	5250±50	−21.6	4.1	4250–3960	*4235–4190* (*13%*) or *4180–3965* (*82%*)
OxA-7986	Sample 5	Aurochs. Disarticulated vertebra	L5. In soil or turfline with Peterborough Ware pottery	4490±45	−23.2	6.4	3370–3020	*3355–3080* (*88%*) or *3070–3025* (*7%*)
OxA-8008	Sample 4	Dog or wolf. Disarticulated humerus	L5, 'base of turf'. In soil or turfline with Peterborough Ware pottery	3915±40	−19.8	9.7	2550–2280	*2555–2535* (*1%*) or *2495–2285* (*94%*)

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$(‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-8007	Sample 3	*Corylus* charcoal	L5. From sample taken from top of buried soil with Peterborough Ware pottery, probably from turfline, on evidence of higher mollusc numbers	4405±45	−25.6		3330–2900	*3330–3230 (13%)* or *3175–3155 (1%)* or *3120–2905 (81%)*
OxA-8006	Sample 2	Caprine. Disarticulated tibia	L4. In silt layer with both Peterborough Ware and Beaker pottery	4410±40	−22.4	4.6	3330–2910	*3325–3230 (13%)* or *3175–3160 (1%)* or *3120–2910 (81%)*
OxA-7985	Sample 1	Pig. Disarticulated femur	L2a. In chalk dump in shaft top with Beaker pottery	3775±45	−21.2	4.9	2350–2030	*2460–2415 (4%)* or *2410–2375 (4%)* or *2350–2120 (85%)* or *2090–2055 (2%)*

Above these again was a hearth dated by a short-life sample of charred plant material, and by two further measurements: one on *Fraxinus* charcoal, which could have come from a tree up to 200 years old, and one on a disarticulated, potentially residual, pig bone (Fig. 4.21: *OxA-8009−10, -7981*). The latter two dates are treated as *termini post quos* in the model. The particular interest of the hearth is that it was associated with Neolithic Bowl pottery, a ground flint axe fragment and cattle bone, and is the earliest evidence for the introduction of Neolithic practices to the area. This can be dated to *3960−3755 cal BC* (*89% probability*; Fig. 4.21: *OxA-8009*) or *3745–3710 cal BC* (*6% probability*)*,* probably to *3945−3850 cal BC* (*46% probability*) or *3845−3830 cal BC* (*5% probability*) or *3825−3785 cal BC* (*17% probability*). If the disarticulated pig bone was from a domesticated animal – which its size suggests (Maltby 2007, 297) – then it points to an even earlier introduction of at least one Neolithic element, in *4235–4190 cal BC* (*13% probability*; Fig. 4.21: *OxA-7981*) or *4180–3965 cal BC* (*82% probability*), probably in *4225–4205 cal BC* (*8% probability*) or *4165–4125 cal BC* (*14% probability*) or *4110–4105 cal BC* (*1% probability*) or *4075–3980 cal BC* (*45% probability*). By this time, conditions had become more shaded (French *et al.* 2007, 306).

There may also have been activity at about this time on the site of the Thickthorn Down long barrow, some 4 km to the south-west. Here a single date of *4050–3905 cal BC* (*76% probabilit*y; Fig. 4.20: *BM-2355*) or *3880–3800 cal BC* (*19% probability*), probably *4040–4010 cal BC* (*16% probabilit*y) or *4005–3940 cal BC* (*50% probabilit*y) or *3855–3845 cal BC* (*2% probabilit*y), on red deer antler from the surface below the mound may reflect incomplete removal of PVA from the sample (Ambers *et al.* 1987, 180). It may alternatively relate to a rod microlith from the same surface (Drew and Piggott 1936, fig. 5: F59). Yet earlier human intervention may be evidenced by a row of three irregular pits sealed by the turfline on which these finds lay. The pits contained only burnt flint and charcoal, which was, in the one case where it was identified, of pine – suggestive of a Boreal date like that of the Hambledon pine samples. Their plans might suggest that they were treeholes (Drew and Piggott 1936, 81, 94, pl. XVI).

In the Fir Tree Field shaft, the early fourth millennium hearth was overlain by a soil containing Peterborough Ware, perhaps formed in open woodland (French *et al.* 2007, 306). This was capped by a turfline, the samples from which are of diverse ages, probably reflecting the length of time over which it persisted (Fig. 4.21: *OxA-7986,-8007–8*). The latest of these, *OxA-8008 (2555–2535 cal BC* (*1% probability*) or *2495–2285 cal BC* (*94% probability*), probably *2470–2390 cal BC* (*45% probability*) or *2385–2345 cal BC* (*23% probability*))*,* indicates that it continued at least into the late third millennium, unless the sample itself was intrusive. Dates on disarticulated bone samples from overlying layers (Fig. 4.21: *OxA-7985, -8006*) can be taken only as *termini post quos* for those layers and the Beaker pottery in them.

Only two of the numerous long barrows in the Chase have been investigated: Thickthorn Down, mentioned above, and Wor Barrow, which was completely excavated by General Pitt Rivers in the 1890s (1898, 58–101). Two dates, both with large standard deviations, are available from this monument, although both are on antler implements from on or close to the base of the ditch (Fig. 4.20: *BM-2283R, -2284R*). On this basis only a broad mid-fourth millennium cal BC construction date can be estimated, indicating that the barrow was built during the main Neolithic use of Hambledon Hill. A further programme of dating by Michael Allen is underway.

Reliable dates from the Dorset cursus are scarce, and all are from its earlier, south-western, part (Barrett *et al.* 1991, fig. 2.8). Leaving aside the two sixth millennium samples discussed above, there are three further measurements on disarticulated bone (Fig. 4.20: *OxA-624–6*) and one on an antler pick (Fig. 4.20: *BM-2438*). One of the disarticulated bones (*OxA-626*) is older than another sample from the same layer (*OxA-625*) and older than the underlying antler pick (*BM-2438*). The other two (*OxA-624–5*), although from successive levels, are not statistically different from each other or from the underlying pick (T'=0.7; T'(5%)=6.0; ν=2), which suggests that they were both redeposited. The pick itself was not from the ditch base but from the partly stabilised surface of the primary silts (Barrett *et al.* 1991, fig. 2.13: marked 'X' on the upper 1984 section). These silts, only 0.20 m deep at this point, could have accumulated very quickly and the pick could have been used in construction and subsequently have fallen or been placed into the ditch. In this case, the best estimate for construction is, following Barclay and Bayliss (1999, 22–3), the age of the pick itself (Fig. 4.20: *BM-2438; 3365–3005 cal BC, 94% probability* or *2980–2955 cal BC* (*1% probability*), probably *3340–3205 cal BC* (*40% probability*) or *3195–3145 cal BC* (*14% probability*) or *3140–3095 cal BC* (*14% probability*)). Alternatively, the stabilised surface on which the pick was found could have persisted for some time and the implement could be a *terminus ante quem* for construction. This reading would accord with the exclusive presence of Bowl pottery in the primary fills, Peterborough Ware occurring only in the secondary silts (Barrett *et al.* 1991, 33, 46). Perhaps more importantly, the multifarious ways in which both parts of the cursus are aligned on and incorporated long barrows (Barrett *et al.* 1991, 36, 47–51) suggest a common tradition. Sections cut across the cursus farther to the north-east suggest that the ditch was backfilled soon after construction (French *et al*. 2007, 106–13).

In the so far unique Monkton-up-Wimborne pit circle/shaft complex, the bodies of a woman and three children were buried in a grave cut into the angle of the base and side of a large pit, in which a deep central shaft was dug after some silt had accumulated; the upcast from this formed a sloping ramp or platform. The whole feature was surrounded by a ring of smaller pits (M. Green 2000, 77–84; French *et al.* 2007, 112–14). Three samples have been dated: a femur from the articulated skeleton of the woman (OxA-8035), charred hazel twigs from the floor of the pit sealed by the platform (Wk-18753), and unidentified charcoal from the upper infill of the shaft (Wk-18754). The earlier part of this complex, represented by the female burial, is dated to *3505–3425 cal BC* (*15% probability*; Fig. 4.20: *OxA-8035*) or *3385–3260 cal BC* (*35% probability*) or *3255–3095 cal BC (45% probability*), probably to *3495–3465 cal BC* (*8% probability*) or *3380–3325 cal BC* (*25% probability*) or *3230–3170 cal BC* (*19% probability*) or *3160–3115 cal BC* (*16% probability*).

Of the dates listed in Table 4.6, the samples for BM-2283R and -2284R were prepared and measured as described by Burleigh *et al.* (1976). Both were recalculated following the identification of a systematic error in British Museum radiocarbon measurements issued during the period between 1980 and 1984. Insufficient material remained to redate the samples and the particularly large standard deviations are a result of recalculation (Bowman 1991). The samples for BM-2355 and -2438 were prepared and measured as described by Ambers *et al.* (1987). Those for OxA-624–8 were prepared as described by Wand *et al.* (1984) and dated as described by Gillespie *et al*. (1984b). Those for OxA-7981, -7985–91, -8000, -8006 and -8008 were prepared and measured as described by Hedges and Law (1989). Those for OxA-8007, -8010–13 and -8097 were prepared and measured as described by R. Hedges *et al.* (1989a). That for OxA-8035 was prepared and dated as described by Bronk Ramsey *et al*. (2000a).

It is clear that the innovations of the early fourth millennium cal BC, represented in the hearth in the Fir Tree Field shaft, were introduced into a long-occupied landscape, and that probably a century or two then elapsed before construction began on Hambledon Hill (*55–300 years, 95% probability*; distribution not shown, probably *125–165 years* (*18% probability*) or *175–280 years* (*50% probability*)). The position of Wor Barrow within the Hambledon sequence is as uncertain as the chronology of the barrow itself. If the construction of the Dorset cursus is indeed dated by *BM-2438*, then it occurred after the cessation of activity on Hambledon Hill (*90% probable*). The burial in the Monkton-up-Wimborne pit circle/shaft complex may have occurred during or after the final period of activity on the hill. As we have discussed above, and as Mercer and Healy have already stated (2008, 768), the reorientation of the earthworks on the hill, at the end of its monumental life, may have been connected with the emergence of a new focus, centred on the massive cursus in the Chase to the east. It is certainly from this time onwards that the tempo of pit-digging and monument construction quickened in the Chase itself, resulting in a plethora of mortuary enclosures, 'hengiforms', henges and Neolithic as well as later round barrows (M. Green 2000, 69–90; French *et al*. 2007).

The molluscan record for the Chase is particularly full. The sixth millennium vegetation was probably one of deciduous woodland with small clearings and openings. There were local clearances around the early fourth millennium hearth in the Fir Tree Field shaft (M. Green 2000; M. Allen 2000; 2007), and the Thickthorn Down and Gussage Cow Down long barrows stood in established

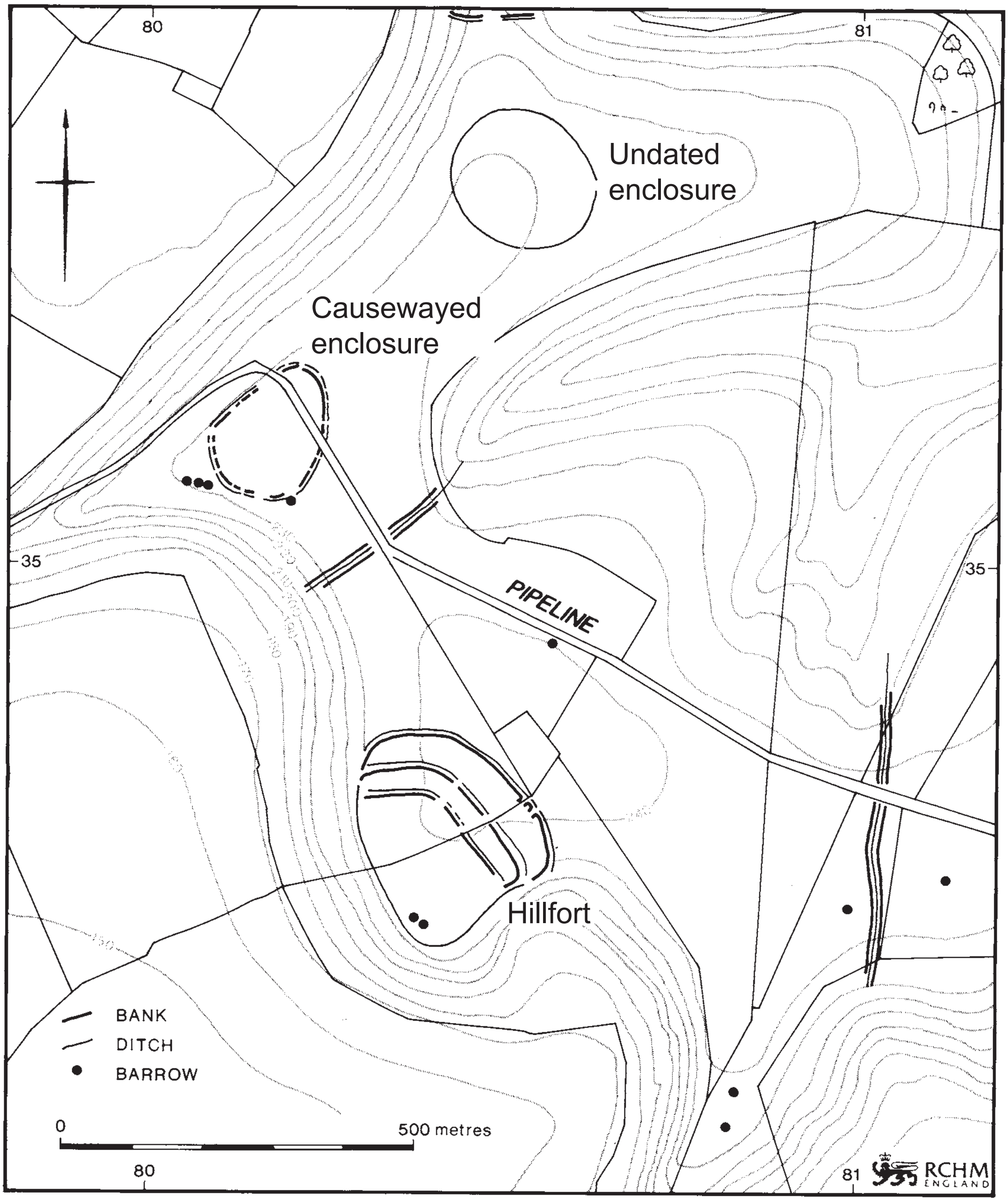


Fig. 4.22. Whitesheet Hill. Plan of the main earthworks, showing the route of the pipeline which was investigated in 1989−90. After Rawlings et al. *(2004, fig. 2).*

open grassland (French *et al.* 2003, 229; M. Allen 2007, 158). There was, however, only local clearance around the perhaps rather later Handley Down mortuary enclosure (M. Allen 2000, 43–4), in contrast to more extensive clearance around another mortuary enclosure (MUW 00) at Monkton-up-Wimborne (French *et al.* 2003, 226; 2007, 112). The Dorset cursus was built in what now seems to have been a combination of scrub and lightly grazed grassland, and the Monkton-up-Wimborne pit circle/shaft complex stood in a large tract of grassland (M. Allen 2002a, 61–3; 2007; M. Green 2007b). This mosaic of habitats in the fourth millennium cal BC contrasts with the record of Hambledon Hill, where substantially wooded conditions persisted throughout the Neolithic sequence, regardless of whether the samples came from the central area or from the Stepleton spur almost 1 km to the south-east (Bell *et al.* 2008). This suggests that the hill remained a place of occasional resort, while the Chase was more consistently occupied, as it had been in the Mesolithic.

4.2 Whitesheet Hill, Kilmington, Salisbury, Wiltshire, ST 8017 3519

Location and topography

Whitesheet Hill lies at 235 m OD on a spur of Middle

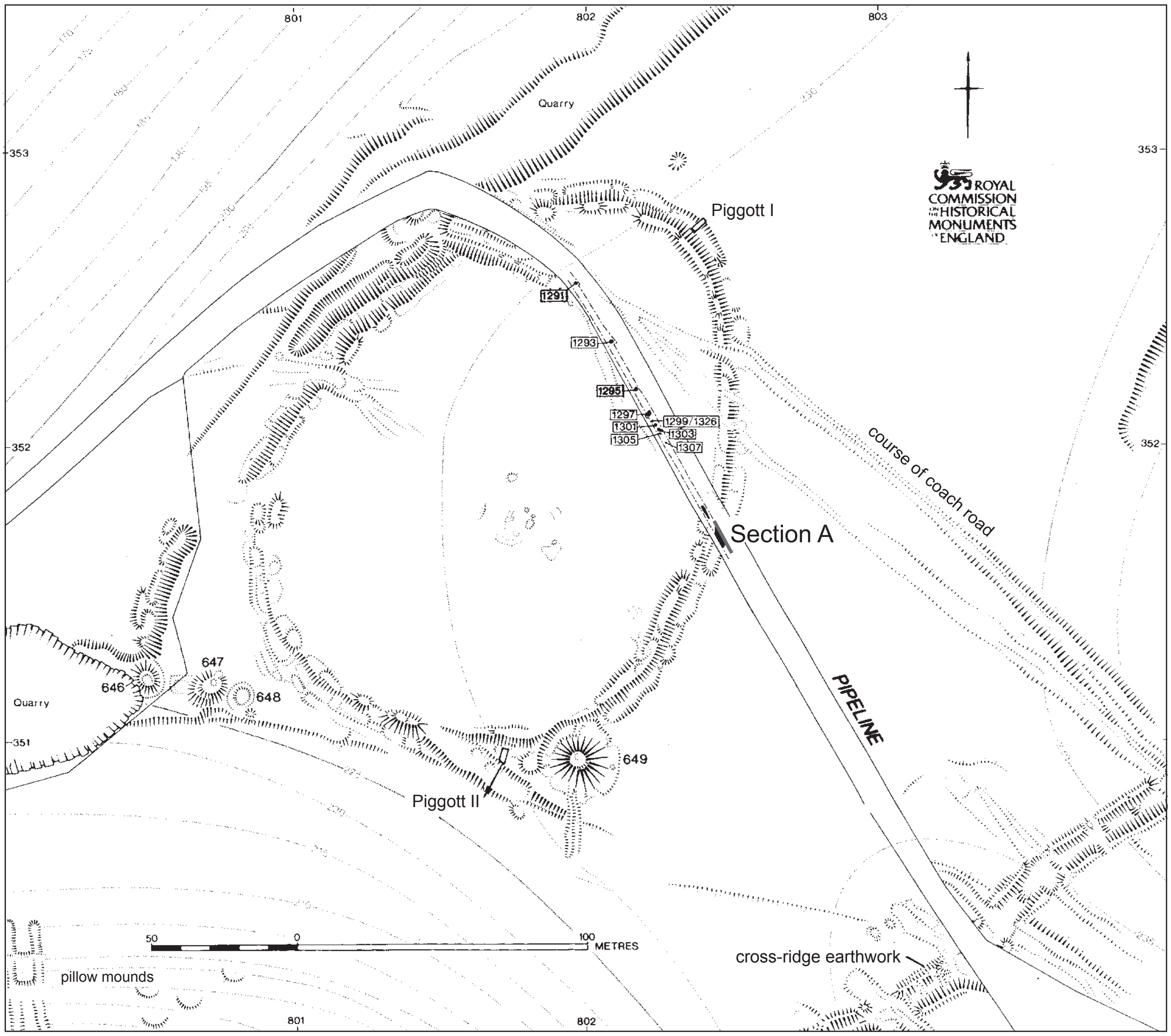


Fig. 4.23. Whitesheet Hill. Plan of causewayed enclosure, showing route of pipeline, location of ditch sections cut in 1951 and 1989−90 and features excavated in 1989−90. After Rawlings et al. *(2004, fig. 3).*

Chalk projecting from the western edge of the Wessex downland and overlooking the low-lying Vale of Wardour (Fig. 4.1). The Neolithic enclosure is close to the spur tip, on to which the one probable entrance opens (Fig. 4.22; Oswald *et al*. 2001, figs 3.16, 8.3), and consists of a single ovoid circuit enclosing 2.3 ha. Its particular interest lies in the possibility that it forms part of a larger complex of Neolithic earthworks, comparable to that on Hambledon Hill, although the potential components may also relate to an Iron Age hillfort 350 m to the south (Figs 4.22–3). These include traces of what may be an earlier ditch circuit beneath the hillfort itself (Corney and McOmish 2004, 148) and a univallate ovoid enclosure 300 m to the north-east of the investigated causewayed enclosure, 3 ha in extent and with possible interruptions to part of its circuit (Corney and McOmish 2004, figs 1, 2, 4). Beyond this is an undated cross-ridge dyke which cuts off another spur. Caution must, however, be exercised in comparing this to the Hambledon cross-dykes, since two further cross-ridge dykes, one between the causewayed enclosure and the hillfort, the other east of the hillfort, may be of later date (Rawlings *et al*. 2004, 180–4). A row of three round barrows along the south side of the spur just outside the enclosure may have been longer before it was truncated by quarrying (Rawlings *et al*. 2004, fig. 3). A further, much larger, round barrow was built over the enclosure ditch in the south of the circuit (Fig. 4.23; Corney and McOmish 2004, fig. 3).

History of investigation

Richard Colt Hoare opened the large round barrow in 1807, finding that it had contained a skeleton but had been dug into before (1812, 42). In the middle of the following century, Leslie Grinsell appreciated the significance of the relationship between barrow and enclosure and recognised that the ditch was interrupted by causeways (Piggott 1952). Grinsell's identification of the site as a causewayed

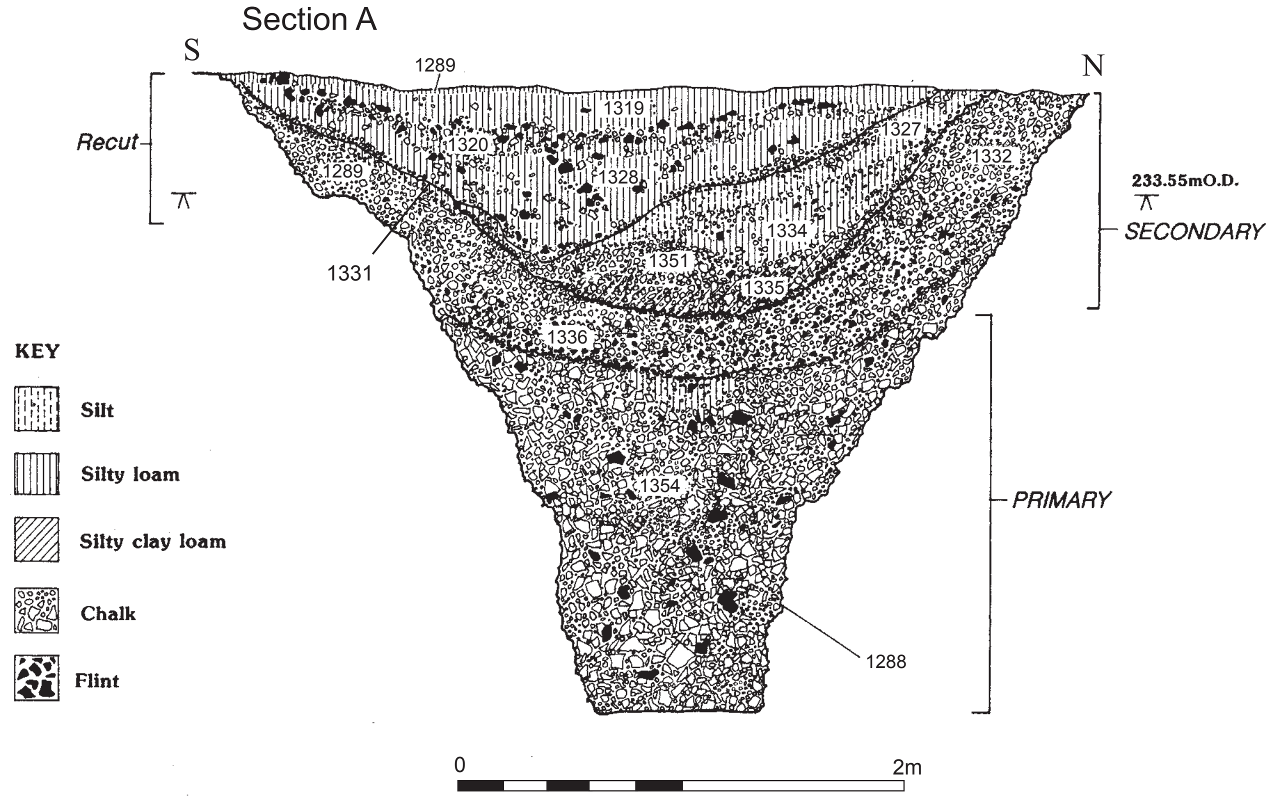


Fig. 4.24. Whitesheet Hill. The ditch section recorded in 1989–90, after Rawlings et al. *(2004, fig. 5). Note that the section was cut at right-angles to the ditch, despite the orientation of the pipeline shown in Fig. 4.23.*

enclosure was confirmed by the excavation of two trenches, one in the north of the circuit and one in the south near the round barrow, by Stuart Piggott and J.F.S. Stone in 1951 (Piggott 1952). The most striking discovery of these very limited excavations was a cattle skull at the junction of the chalk rubble and finer silts in the northern cutting, where the published sections can be read as showing a subsequent recut, made when the ditch was almost fully silted (Piggott 1952, 408, fig. 2). The south cutting bottomed on solid chalk a little below the surface, and may have been sited on a causeway.

Earthwork survey by RCHME and further excavation by Wessex Archaeology, supervised in the field by Mick Rawlings, took place in 1989–90 in advance of the laying of a water pipeline. This provided a transect across the north part of the enclosure, including a ditch section in the east of the circuit and at least five Neolithic features in the interior, as well as natural formations (Fig. 4.23). The ditch section was exceptionally deep and narrow, extending to 2.80 m below the surface of the chalk and measuring less than 1 m wide at the base. The north section of Piggott and Stone was similarly narrow at the base, but was only 1.20 m deep from the chalk surface. It is impossible to judge which is more representative of the circuit. The steep and narrow profile of the 1990 section almost certainly accounts for its lowest fill of almost 1.75 m of undifferentiated chalk rubble (Fig. 4.24; Rawlings *et al.* 2004, fig. 5: context 1354), which must have accumulated rapidly. The rubble fills contained predominantly South-Western style Bowl pottery, including a gabbroic vessel, animal bone, and struck flint. A recut in the secondary fills at a comparable level to that inferred from Piggott's north section contained a single Peterborough Ware sherd. The internal pits, the nearest of which was over 40 m from the ditch, contained similar artefacts to the primary ditch fills, but the animal bone from them was dominated by pig rather than cattle. They also contrasted dramatically with the ditch fills in the frequency of burnt material in them: charcoal, charred hazelnut shells, burnt bone and burnt flint, all of which were virtually absent from the ditch. None of this material was burnt *in situ*, and, combined with the frequency of pig remains, the deposits could be the residue of an episode or episodes of roasting and consumption. Molluscs were scant in the primary ditch fills but, as far as they go, indicate an environment with some shade. Shade-loving species persisted through the secondary fills alongside others indicating some open environments. The recut corresponded to an intensification in local landuse, probably by grazing. Spot samples from two pits were dominated by shade-loving species and almost without open country taxa.

Previous dating

Following the 1989–90 excavations, four samples of bulk animal bone and two samples of bulked charred hazelnut shell fragments were submitted to the British Museum Radiocarbon Laboratory for dating by LSC (Fig. 4.25; Table 4.7; Rawlings *et al.* 2004, table 1), and were

Table 4.7. Radiocarbon dates from Whitesheet Hill, Wiltshire. Posterior density estimates derive from the model defined in Fig. 4.26.

Laboratory number	Sample reference	Identification	Stratigraphic details	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Ditch								
BM-2785	W347.1595	Animal bone. Bulk sample, mainly of cattle. Mark Maltby's archive (in the Salisbury and South Wilts Museum) records 14 identifiable elements in sf 1595, all but one of them from cattle, among which mature and immature individuals were represented. The submission form reads 'Includes tarsals, metatarsals, carpals, metacarpals, phalanges, atlas, vertebra, thoracic vertebra'. Since only the mineral residue remains of the sample it is clear that all of the bones were dated	Feature 1288, context 1354. Loose, unsorted chalk rubble with a few chalk nodules lying directly on base of ditch and up to 1.75 m deep. Sample found at 231.32 m OD, near base of layer (Rawlings *et al.* 2004, fig. 5). All the bones in the sample formed part of a single measured-in find (sf 1595), so that they would have been deposited together, perhaps in the immediate aftermath of consumption	4820±50	−21.3		3700–3510	*3650–3625* (*8%*) or *3605–3535* (*87%*)
BM-2784	W347.1584.1	Pig. Bulk sample. Maltby notes that it is feasible that the bones belonged mainly to 1 or 2 animals (2004, 167). The submission form reads 'Includes jaw, radius, femur, frontal skull, 1st phalanx, metapodials, rib'. Since only the mineral residue remains of the sample it is clear that all of the bones were dated	From the same layer as BM-2785. Sample found at 231.97 m OD, above middle of layer (Rawlings *et al.* 2004, fig. 5). Like sf 1595, this was a single measured-in find, so that its components would have been deposited together, perhaps in the immediate aftermath of consumption	4800±70	−19.3		3710–3370	*3640–3625* (*2%*) or *3595–3520* (*93%*)
OxA-15290	W347.1354.1	Sheep. 3 rib fragments from the skeleton of an animal between 6 and 10 months old, represented by 49 bones. 'There is no evidence of butchery and it is assumed that this skeleton was dumped in an articulated state. Most of the skeleton was recovered except the carpals, tarsals and phalanges. The absence of these small bones may result from recovery bias or poor preservation and it is possible that the sheep was originally dumped as a complete carcass' (Maltby 2004)	From the same layer as BM-2785. There is no record of the depth at which the skeleton was found	4822±32	−21.6		3660–3520	*3645–3630* (*4%*) or *3590–3525* (*91%*)
GrA-30068	W347.1584.2	Red deer. Antler beam with one tine, and recent breaks. Found with many small antler fragments. Almost certainly the remains of an antler pick	From the same layer as BM-2785. Sample found at 231.97 m OD, above middle of layer (Rawlings *et al.* 2004, fig. 5). Part of same small find as sample for BM-2784	4825±40	−23.0		3700–3520	*3640–3625* (*2%*) or *3590–3525* (*93%*)
OxA-15291	W347.1354.2/A	Cattle. Proximal phalanx, articulating with medial and distal phalanges. Replicate of GrA-30071	From the same layer as BM-2785. The bones were extracted from a bulk find and their precise position is unknown	4768±33	−21.7	4779±27 T'=0.3; T'(5%)=3.8; ν=1	3650–3520	*3640–3625* (*2%*) or *3595–3525* (*93%*)
GrA-30071	W347.1354.2/B	Cattle. Medial phalanx, articulating with proximal and distal phalanges. Replicate of OxA-15291	From the same layer as BM-2785. The bones were extracted from a bulk find and their precise position is unknown	4800±45	−22.2			
GrA-30067	W347.1579	Red deer. Antler beam with base of recently broken-off tine, found with many antler fragments. Almost certainly the remains of an antler pick	From the same context as BM-2785. Antler found at 232.12 m OD (Rawlings *et al.* 2004, fig. 5)	4695±40	−22.7		3640–3360	*3635–3625* (*1%*) or *3620–3510* (*94%*)
BM-2783	W347.1328	Animal bone. Bulk sample, mainly of pig. Bags for small finds 1441 and 1443, both from 1328, are empty and marked 'bone for C14'. Maltby's archive identifies 1441 as pig occipital and scapula, 1443 as pig lateral metapodial and large mammal fragment. The submission form reads 'Includes occipital, scapula'. Gnawed and weathered. Since only the mineral residue and a minute scrap of unaltered bone remain of the sample, it is clear that all of the bones were dated	Feature 1331, context 1328. Lower fill of recut in silted ditch (Rawlings *et al.* 2004, fig. 5), with 1 sherd Peterborough Ware	5020±150	−19.5		4230–3510	

Laboratory number	Sample reference	Identification	Stratigraphic details	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
Internal features								
GrA-30072	W347.1322.4	Charred hazelnut shell fragment	Pit 1295, context 1322. Extracted from basal fill of pit (Rawlings *et al.* 2004, fig. 7)	4765±40	−25.7		3650–3370	*3640–3625* (*2%*) or *3605–3520* (*93%*)
OxA-15322	W347.1322.3	Charred hazelnut shell fragment	From the same context as GrA-30072	4797±33	−24.3		3650–3520	*3640–3625* (*3%*) or *3595–3525* (*92%*)
BM-2823	W347.1322.2	Charred hazelnut shells	From the same context as GrA-30072	4740±35	−25.0 (estimated)		3640–3370	*3635–3625* (*2%*) or *3610–3520* (*93%*)
BM-2821	W347.1322.1	Pig. Bulk sample. The submission form reads 'Jaw, long bones, etc.', the published list reads 'pig long bones' (Rawlings *et al.* 2004, table 1). Some long bone fragments and teeth survive from the sample	From the same context as GrA-30072. Described on submission form as 'bulked *in situ* spot find of associated bone'	4750±90	−20.6		3710–3350	*3640–3625* (*2%*) or *3610–3520* (*93%*)
OxA-15292	W347.1342.1	Pig. R radius with both fitting unfused epiphyses. 'Most of the pig bones in these fills [of feature 1303] could have belonged to two immature animals' (Maltby, original report in archive, detail missing from published version)	Pit 1303, context 1342. Upper fill of the first of two successive pits, stratified above 1346 (Rawlings *et al.* 2004, fig. 6)	4830±32	−19.4		3660–3530	*3580–3525*
OxA-15293	W347.1346.2	Cattle. 1 of 2 consecutive thoracic vertebrae from same immature individual, a third probably consecutive vertebra coming from the same context	Pit 1303, context 1346. Basal fill of the first of two successive pits, stratified below 1342 (Rawlings *et al.* 2004, fig. 6). No sign of *in situ* burning, probably dumped burnt material	4823±33	−21.5		3660–3520	*3645–3630* (*5%*) or *3590–3530* (*90%*)
GrA-30073	W347.1697.2	Charred hazelnut shell fragment	From the same context as OxA-15293	4845±40	−25.2		3710–3530	*3650–3630* (*6%*) or *3590–3530* (*89%*)
BM-2822	W347.1346.1	Charred hazelnut shells	From the same context as OxA-15293	4790±50	−23.9		3660–3370	*3640–3625* (*3%*) or *3605–3530* (*92%*)
OxA-15323	W347.1697.1	Charred hazelnut shell fragment	From the same context as OxA-15293	4726±34	−28.2		3640–3370	*3635–3625* (*2%*) or *3615–3530* (*93%*)
GrA-30074	W347 1699.2	Charred hazelnut shell fragment	Pit 1293, context 1350. Deposit of charcoal and charred plant remains up to 0.10 m thick on pit base in lower part of some areas of 1323 (Rawlings *et al.* 2004, fig. 70)	4740±40	−22.0		3640–3370	*3635–3625* (*2%*) or *3610–3520* (*93%*)
OxA-15324	W347 1699.1	Charred hazelnut shell fragment	From the same context as GrA-30074	4775±35	−26.5		3650–3380	*3640–3625* (*2%*) or *3600–3520* (*93%*)

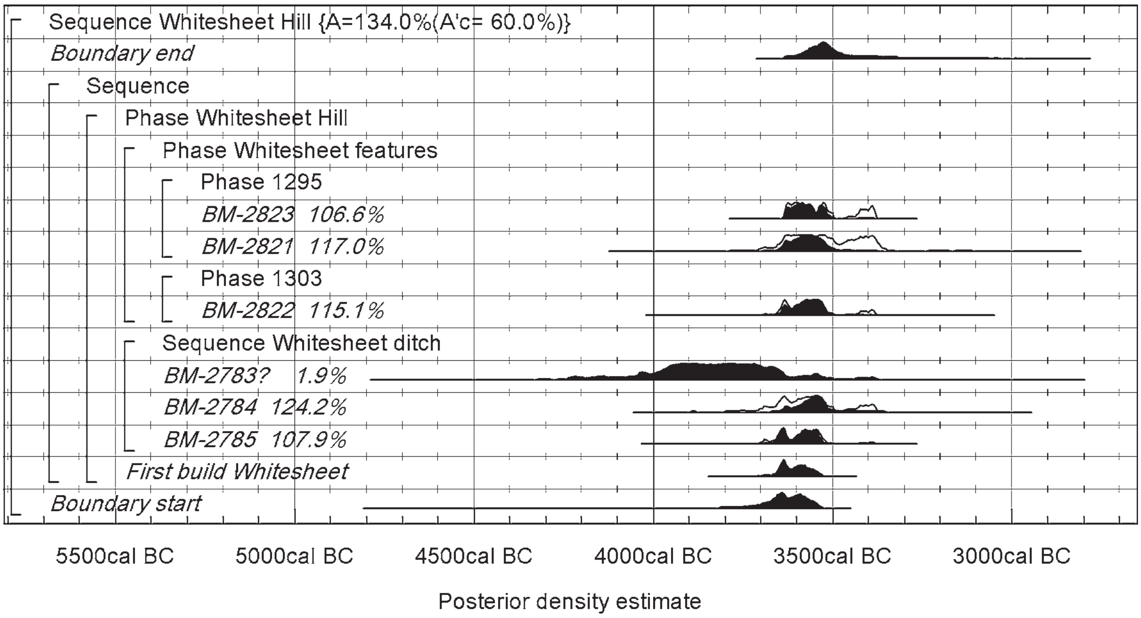


Fig. 4.25. Whitesheet Hill. Probability distributions of dates (using radiocarbon determinations obtained before 1998). The format is the same as for Fig. 4.5. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

processed and dated according to the methods described by Ambers and Bowman (1998). Two animal bone samples (BM-2784–5) were dated from the primary chalk rubble of the ditch (context 1354). Both samples consisted of several fragments of disarticulated animal bone. However, despite the uncertainties over sample integrity, it is probable that these samples may in fact be close in age to the actual date when this rubble formed in the ditch, since the results are statistically consistent (T'=0.1; T'(5%)=3.8; ν=1) and both samples were from discrete dumps of well preserved bone in rapidly accumulating fill which could well have resulted from individual episodes of consumption. These two samples were interpreted in the publication (Rawlings *et al*. 2004) as giving a date for construction and the start of infilling of 3710–3380 cal BC. From the recut described above, gnawed, weathered fragments of pig and one from a large mammal were submitted for dating (BM-2783). In the event this sample proved to be considerably earlier than the samples stratified below it (BM-2784–5) and was retrospectively recognised as redeposited. Turning to the interior, the bone from the lowest fill of pit 1295 (BM-2821) is statistically indistinguishable from BM-2823, measured on charred hazelnuts from the same context (T'=0.0; T'(5%)=3.8; ν=1). Although the hazelnuts were bulked, they were short-lived, and it is highly plausible that both samples were freshly deposited. Another deposit in a separate pit of probably fresh charred hazelnuts was dated (BM-2822) and gave a result which is statistically consistent (T'= 0.7; T'(5%)=6; ν=2) with the others from the interior pits. These three dates from the pits were seen as indicating that activity within the enclosure was contemporary with, rather than earlier than, the construction of the circuit (Rawlings *et al*. 2004, 154–5).

Reassessment and modelling of existing dates

A chronological model for the six original dates is given in Fig. 4.25. BM-2783, the redeposited sample in the recut, has been excluded from the model. Although the bone samples were bulked and could include material of diverse ages, they appear to form a coherent series. It also appears that the interior pits form part of the overall phase of use of the enclosure. The model suggests that the enclosure was built in *3790–3520 cal BC* (*95% probability*; Fig. 4.25: *build Whitesheet*), probably in *3670–3550 cal BC* (*68% probability*).

Objectives of the dating programme

The dating programme set out to test and refine this estimate by measuring articulating animal bones, antler implements and single charred hazelnut shell fragments from the 1989–90 excavations, since the 1951 material could not immediately be located.

Sampling strategy and simulation

Sampling was restricted by the limited scale of the excavation. It was clear, however, that articulated and articulating bone and large quantities of charcoal and charred hazelnut shells were present (Maltby 2004; Hinton 2004). The ditch provided three articulating bone samples and two antler implements. Simulation suggested that further measurements from the pits in the interior might refine the estimate possible on the basis of the limited number of ditch samples. The comparison of new measurements on articulating bone and single fragments of charred hazelnut shell with the existing dates on bulk

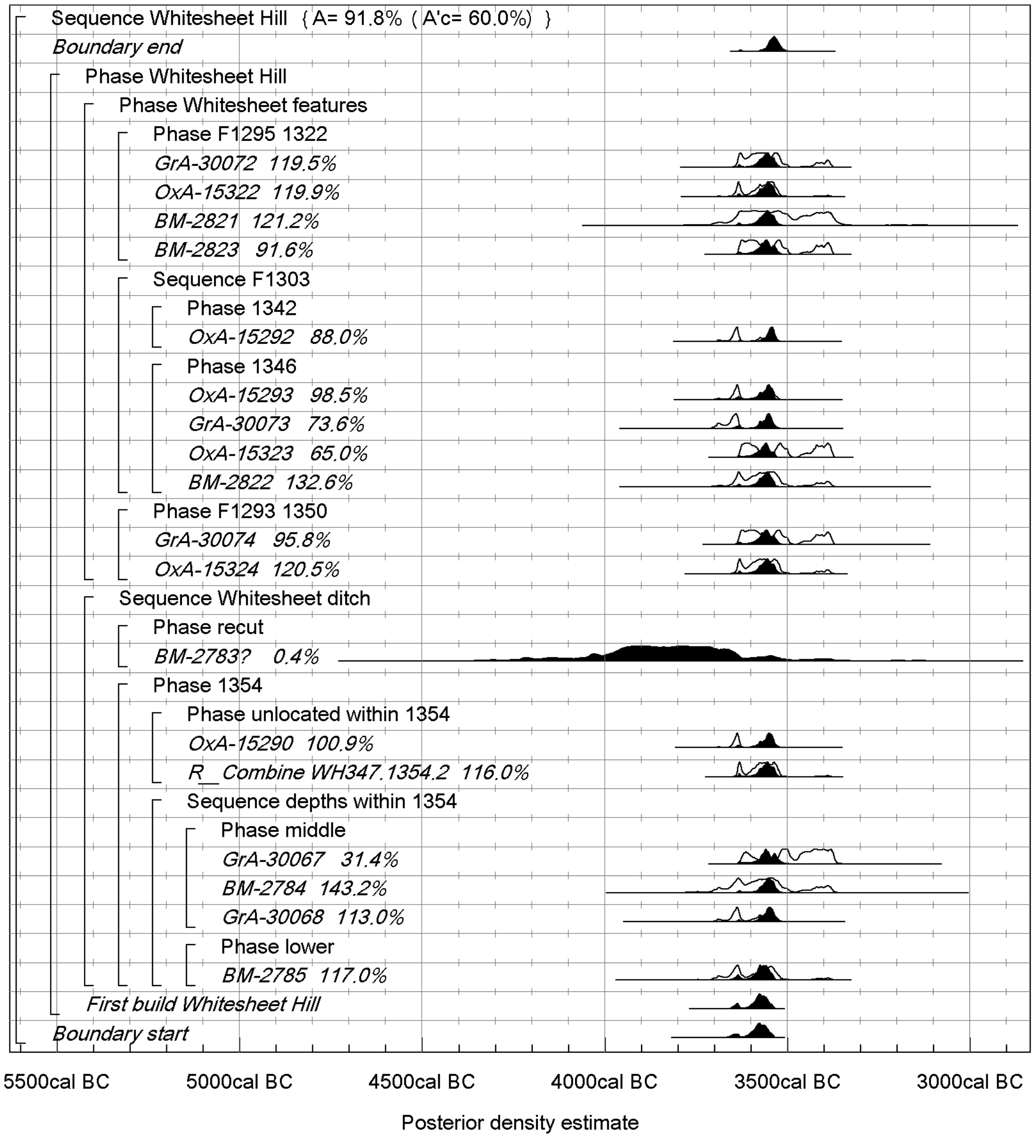


Fig. 4.26. Whitesheet Hill. Probability distributions of dates from the causewayed enclosure. The format is the same as for Fig. 4.5. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

material would also give us a better indication of the reliability of the conventional measurements.

Results and calibration

Details of all the radiocarbon measurements from Whitesheet Hill are provided in Table 4.7.

Analysis and interpretation

The ditch. Four further samples were obtained from the primary rubble fill 1354. Two antler implements (GrA-30067–8) were recovered from a similar level to BM-2784, more than half way up the layer and hence stratified above BM-2785 which was near the ditch base (Rawlings *et al.* 2004, fig. 5). The depths of two further samples from the layer were not recorded. These were rib fragments from an immature sheep skeleton (OxA-15290) and articulating cattle phalanges on which statistically consistent replicate measurements were made (OxA-15291, GrA-30071; T'=0.3; T' (5%)=3.8; ν=1). The radiocarbon measurements on all six samples are statistically consistent (T'=7.9; T'(5%)=11.1; ν=5). This suggests that the bulked disarticulated bone samples dated by BM-2784–5 were freshly deposited; they are therefore retained in the model. As discussed above, BM-2783 appears to include redeposited material and has been excluded from the analysis.

The internal features. Samples were dated from three pits, spaced at intervals of 15 and 20 m from each other, and hence unlikely to form part of a single cluster. Four have been dated from the basal fill of pit 1303. One (OxA-15293) was articulating animal bone; two (OxA-15323, GrA-30073) were single charred hazelnut shell fragments, and one (BM-2822) was a bulk sample of charred hazelnuts. All four measurements are statistically consistent (T'=6.4; T'(5%)=7.8; ν=3). This suggests that BM-2822 was made

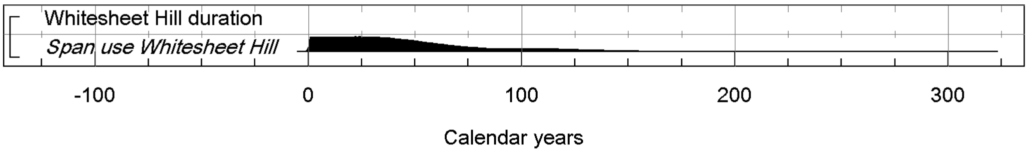


Fig. 4.27. Whitesheet Hill. Probability distributions of the number of years during which the causewayed enclosure was in use (derived from the model defined in Fig. 4.26).

on freshly deposited shells, as does the quantity of shell from the pit (Hinton 2004, table 9). From the overlying layer came a pig radius with fitting epiphyses (OxA-15292). This makes it unlikely to have been redeposited, so that it should be later than the samples from the layer below. When this relationship is included in the model it shows good agreement (A=88.0%; Fig. 4.26).

Two further hazelnut shell fragments (GrA-30072, OxA-15322) were dated from the bottom fill of pit 1295, from which a bulk hazelnut shell sample (BM-2823) and a bulk bone sample (BM-2821) had already been dated. All four results are statistically consistent (T'=1.5; T'(5%)=7.8; ν=3), again demonstrating the reliability of the measurements on the bulk samples. Two charred hazelnut shell fragments from the basal fill of a third pit, 1293, were also dated (GrA-30074, OxA-15324). These samples also produced statistically consistent measurements (T'=0.4; T'(5%)=3.8; ν=1).

The chronological model incorporating this archaeological information with the radiocarbon results is shown in Fig. 4.26. This suggests that the enclosure was built in *3655–3630 cal BC* (*10% probability*; Fig. 4.26: *build Whitesheet Hill*) or *3610–3535 cal BC* (*85% probability*), probably in *3595–3550 cal BC* (*68% probability*). The circuit seems to have been used for a relatively brief period, for *1–125 years* (*95% probability*; Fig. 4.27: *use Whitesheet Hill*), probably for *1–55 years* (*68% probability*). It is plausible that the main phase of activity lasted for only a few generations or less.

Implications for the site

It will take further work in the immediate vicinity of the site, with its other possible Neolithic earthworks, and beyond, where rather few long barrows are known (Ashbee 1970, fig. 6), before the local significance of these results can further be appreciated.

4.3 Maiden Castle, Winterborne St Martin, Dorset, SY 6693 8848

Location and topography

Maiden Castle lies at 130 m OD on a saddle-backed hill of Upper Chalk, separated from the South Dorset Ridgeway by the valley of the South Winterbourne (Fig. 4.1). The Neolithic enclosure occupies only the eastern knoll of the hill, and is tilted eastward off its highest point (Oswald *et al*. 2001, fig. 5.24: B). The most open and extensive views are of the relatively low-lying interfluve of the South Winterborne and the Frome to the north, the chalk rising again to the west (Woodward *et al*. 1991, fig. 3). The enclosure has an approximate area of 8 ha, making it one of the larger examples in England (Fig. 4.29; Oswald *et al*. 2001, fig. 4.23). It is overlain by a large and complex Iron Age hillfort, which in its extended form encompassed both knolls of the hill (Fig. 4.28). This has restricted investigation of the enclosure circuits which has been confined to the east and west, where they are obscured and damaged by the substantial earthworks of the first hillfort (Fig. 4.29). The certain and possible pre-Iron Age earthworks on the hill are summarised in Table 4.8. Within the ramparts of the hillfort, the west side of the Neolithic enclosure is overlain by the long mound, a 500 m-long earthwork which follows a false crest to the north of the summit of the hill, apparently constructed to be seen from that direction (Fig. 4.28; Balaam *et al*. 1991, 40–1, fig. 29), in other words from the Dorchester area, with its later monuments. Long barrows lie to the west and north-west (Woodward *et al*. 1991, fig. 14).

History of investigation

The spectacular hillfort has long attracted antiquarian attention, and was the scene of excavations by Edward Cunnington in the late nineteenth century (Wheeler 1943, 6–8). The Neolithic enclosure and long mound were not, however, identified until Mortimer Wheeler's excavations of 1934–7 (Figs 4.29 and 4.31), undertaken '(1) to investigate the structural history of the great fortifications which are now the distinctive feature of the site; (2) to identify and correlate the associated cultures; (3) to explore the possibility of recovering some part of the [Iron Age] town plan' (Wheeler 1943, 3–4). In the course of this campaign Wheeler established the main features of the Neolithic use of the hill, which may be summarised as follows.

The earliest phase of the hillfort, which was confined to the eastern knoll, followed the line of two concentric circuits of causewayed ditch approximately 15 m apart, the inner far richer in finds than the outer. This to some extent reflected different histories of infilling, the inner having numerous successive fills at both sides of the circuit (Wheeler 1943, 19, 82, pls VI and XI), but the outer, at least in the area of the eastern hillfort entrance, being full to the top with chalk rubble (Wheeler 1943, pl. LXXIII). We emphasise that, although Wheeler encountered the outer ditch on the west side of the enclosure in four trenches (Wheeler 1943, pl. I), his descriptions of it here are minimal. For site R, for example, he simply records the presence of the outer 'town-ditch' with its irregular

Fig. 4.28. Maiden Castle. Overall plan, showing extent and tripartite nature of long mound, after Sharples (1991a, fig. 29). The Neolithic causewayed enclosure occupies the eastern knoll and is obscured by the Iron Age hillfort.

Table 4.8. Certain and possible pre-Iron Age features at Maiden Castle, Dorset.

Element	Notes	Investigation
Inner ditch	Overlain by E end of long mound and by rampart of first hillfort	Roughly 30 m excavated by Wheeler; 2 cuttings re-excavated and extended by Sharples in trenches I and II, exposing some 12 m length of ditch and approx. half that amount of undisturbed deposit
Outer ditch	No direct evidence for stratigraphic relation to long mound, although backfilling shortly after excavation could have been a prelude to construction of long mound	Roughly 20 m excavated by Wheeler; 3 cuttings re-excavated and extended by Sharples, exposing some 3 m length of ditch and 2 m of undisturbed deposit in trench V, minimum amounts of both in trenches II and VI, where the ditch was severely truncated by that of the first hillfort
Long Mound	Approx. 500 m long and 15 m wide, denuded except where overlain by Iron Age rampart. Running along false crest N of summit of ridge. In three sections, separated by areas with no trace of bank: central section 65 m long and most prominent, E section 157 m long, W section 225 m long. E section built over inner causewayed enclosure ditch	Identified and excavated by Wheeler, most fully at E end and at intersection with inner enclosure ditch; several slit trenches in centre and west, especially in N ditch (1943, pl. III). N side of Wheeler's cutting across mound and inner causewayed enclosure ditch re-excavated and expanded by Sharples in trench I, exposing some 3 m length of N ditch and half that length of undisturbed deposit. Group of Wheeler's cuttings on N side of central part of mound also re-excavated and expanded in trench III, exposing 9 m length of ditch and some 4–5 m of undisturbed deposit (Sharples 1991a, 54–6). Earthwork more precisely defined by earthwork and geophysical survey (Balaam *et al.* 1991, 40–1, fig. 29)
Discrete features	Pits and a few postholes. Pottery from pits comprises Neolithic Bowl (the majority), Grooved Ware and Beaker, the last two in the E entrance area only	Several pits excavated by Wheeler outside enclosure in E entrance of hillfort and inside enclosure in area of long mound (i.e. where they were best protected from Iron Age and later disturbance), one by Sharples in trench IV
Bank between inner and outer causewayed ditches	Approx. 0.50 m high and 3.5 m wide, post-dating ditches	Identified by Wheeler in E entrance area (1943, pl. XI) and by Sharples in trench II (1991a, figs 59–60)
Round barrows	One on W knoll within hillfort, perhaps another on E knoll. Uncertain if Roman burial found by Cunnington, probably in W barrow (Wheeler 1943, 7–8), was primary or secondary	Second possible barrow north of long mound identified by earthwork and magnetometer survey (Balaam *et al.* 1991, 40–1, fig. 29: M).
Third ditch?	In E entrance area 30 m outside the outer one, underlying the tail of the expanded hornwork in the east hillfort entrance (Sharples 1991a, 50)	Some 8 m excavated by Wheeler (1943, pls XII, CXIX).
Palisades?	In E entrance, without stratigraphic relation to definitely Iron Age features (Sharples 1991a, 60)	Exposed and planned by Wheeler (1943, pl. CXIX: 'early palisades').
Cross-ridge dyke?	Running NW–SE along saddle between Maiden Castle and Hog Hill. Subsequently partly overlain by extension of W hillfort entrance	More fully defined by earthwork survey (Balaam *et al.* 1991, 38, fig. 29)
Undated enclosure	Outside causewayed enclosure and S of long mound, at head of dry valley separating two knolls encompassed by hillfort. 40 m x 45 m, ovoid as far as course can be traced, possible single entrance, coinciding with area of low magnetic susceptibility and low phosphate values	Identified by magnetometer survey (Balaam *et al.* 1991, figs 30–2)
Linear ditches?	2 possible linears converging on hill from north and east (the latter ?= Wheeler's Y ditch; 1943, fig. 8), predating hillfort	Defined during earthwork survey (Balaam *et al.* 1991, 38–9, fig. 29)

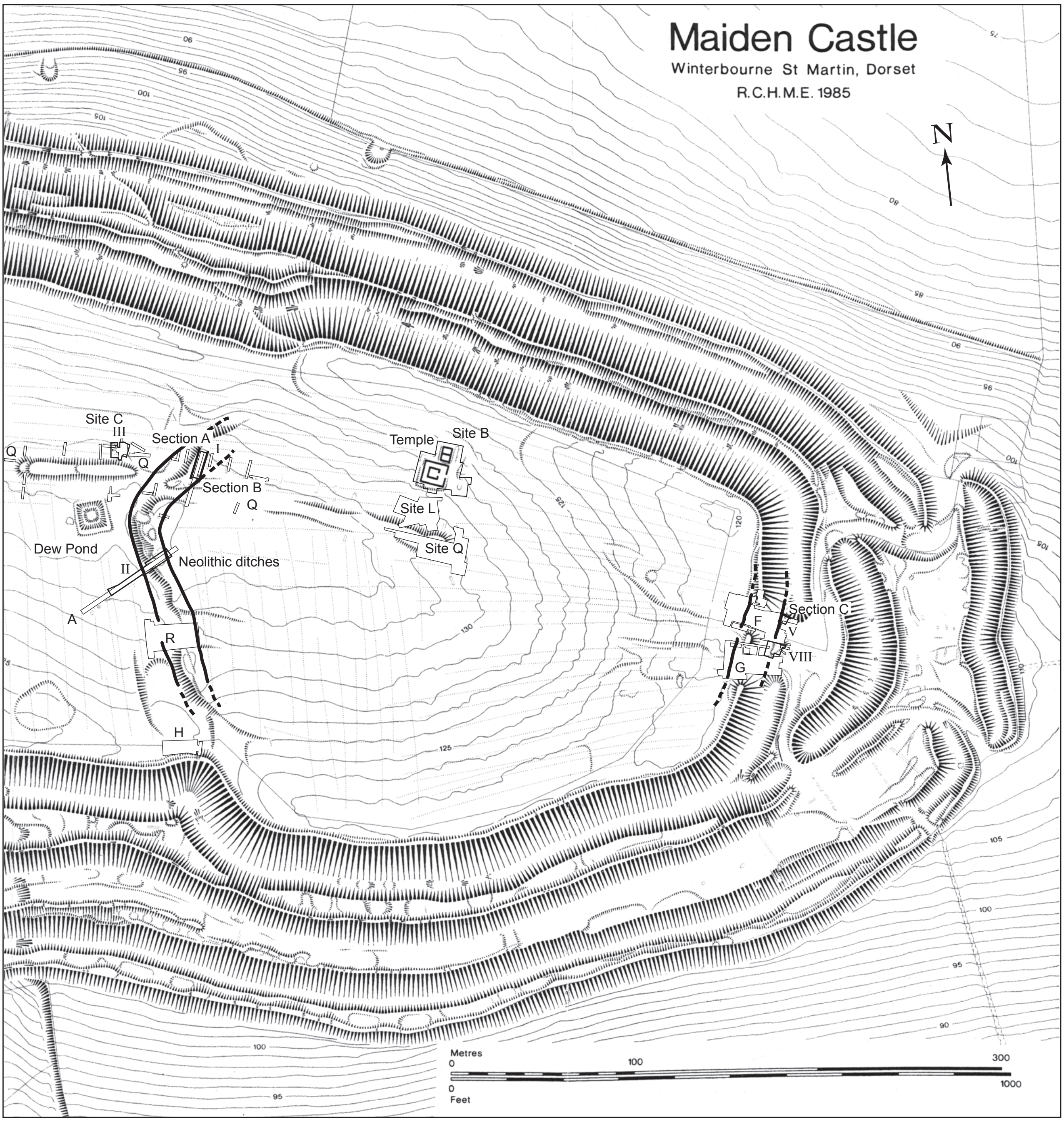


Fig. 4.29. Maiden Castle. The eastern knoll showing cuttings and the line of the two causewayed enclosure ditches, after Wheeler (1943, pl. I) and Sharples (1991a, figs 36, 42).

cut and 'characteristic 'Windmill Hill' interruption' but says nothing at all about the nature of the fill, other than noting the presence of a human skull in it (Wheeler 1943, 83–5, fig. 13).

There was a single small bank between the two ditches, in both the east and the west of the circuit (Wheeler 1943, pls VI, XI). The second of these sections shows that it was built after a turfline had formed over the silted inner ditch.

Once the inner Neolithic ditch and, presumptively, the outer were substantially full and a turfline had developed over them, a mound 500 m long and quarried from flanking ditches (Fig. 4.32) was built across them, extending from the interior of the enclosure in the east on to the second knoll of the hill to the west. It was built within the currency of Neolithic Bowl pottery ('Neolithic A' in the terminology of the time). Above the initial silts of the eastern butts of the long mound ditches were concentrations of cattle bone, especially in the south ditch, where a dark deposit contained parts of four or five cattle skulls, identified as 'a domesticated form of the urus' (Wheeler 1943, 88, pls IV and LXV; Jackson 1943, 361–2).

There were inhumation burials in the area of the long mound, although their stratigraphic relation to it was

sometimes uncertain because of its denuded state. Some were Roman (Wheeler 1943, pls III and V); and one was clearly Saxon (Wheeler 1943, 78–9); but two were ascribed to the Neolithic: the dismembered and cut-about body of a young man (Wheeler 1943, 20–2, 344–6, pls XLI–XLII), and the fully articulated skeletons of two children, buried 'head to tail' (skeletons Q2 and Q3; W, 22, 344, pl. IV), accompanied by a very small, plain round-based cup (Wheeler 1943, fig. 29: 50).

There were pits containing cultural material indistinguishable from that of the lower fills of the enclosure ditches and the initial fills of the long mound ditches both within the enclosure and outside it to the east.[3] In addition to polished stone and flint axeheads, Neolithic levels yielded much larger numbers of complete and fragmentary flaked flint axeheads, some of them apparently unfinished (Wheeler 1943, 162–71). The exclusively Neolithic Bowl (Neolithic A) pottery of the lower fills of both the enclosures ditches and the long mound was augmented, as the fills accumulated, by Peterborough Ware (Neolithic B), Beaker and Early Bronze Age wares appearing only at higher levels (Wheeler 1943, 83). In contrast to the widespread occurrence of Peterborough Ware and Beaker, Grooved Ware was confined, except for one sherd, to a single pit in the eastern hillfort entrance (Piggott 1943, 143; Cleal 1991, 181–3, tables 140–1, microfiche M9: D11).

In 1951, Richard Atkinson cut a section across the long mound near the western end, though not through its flanking ditches, to determine whether that part of the monument had had a central bank (1952). He found no surviving earthwork but concluded that the restricted distribution of Iron Age features, which ceased to occur 17 ft (5m) inside the north ditch, could be interpreted as reflecting preferential construction along the north side of an upstanding mound, which would have provided shelter from the prevailing south-west wind. His section shows a band of protected chalk at least 6 m and possibly up to 8 m wide (its southern limit lying within an unexcavated length of the trench), well inside the ditch edges, indicating, like the distribution of Iron Age features, that there was a substantial berm between mound and ditches. No further fieldwork took place at Maiden Castle for three and a half decades, although aspects of the Neolithic complex were reinterpreted.

Isobel Smith pointed out (1966a, 471–4), as Wheeler had not, that his section across the successive inner causewayed enclosure circuit and long mound (1943, pl. V) showed that, if the enclosure ditch had ever had an internal bank, this had vanished by the time the long mound was built. She interpreted this, and asymmetrical fill patterns in other causewayed enclosures, as reflecting the deliberate use of bank material to cover deposits of cultural material placed in the ditches.

Don Brothwell (1971) recognised that the cuts on the mutilated 'Neolithic' skeleton from the long mound had been inflicted by a metal blade or blades; reconstructed the precise nature of the injuries; and obtained a radiocarbon date of cal AD 600–900 (1315±80 BP; Table 4.9: BM-458) on the skeleton itself. This measurement is not included in the present analysis.

Richard Bradley (1983) suggested that the most prominent, central, part of the long mound, separated from its west end by a slight change of alignment and from its east end by a marked change of alignment and a causeway in the north ditch just outside the Neolithic enclosure (Wheeler 1943, pl. III), may originally have been a long barrow which was subsequently extended to west and east. Caroline Grigson (1984) concluded that three of the cattle skulls from the east butt of the south long mound ditch were not domestic but aurochs, one of them male.

A new campaign of fieldwork took place in 1985–6, funded by English Heritage and directed by Niall Sharples (Sharples 1991a; 1991b; n.d.). It arose from a need to update the presentation and interpretation of the site and to inform its management, and was timed to coincide with the World Archaeological Congress held in Southampton. The project entailed landscape survey around the monument as well as detailed earthwork and geophysical survey of the hilltop itself. Excavation was confined to the emptying and restricted expansion of four of the many Wheeler trenches, with two new cuttings in adjacent areas. The main research questions were to be the changing environment from the Neolithic to the Roman period, the Iron Age cultural sequence, and the development of the eastern gates (Wainwright and Cunliffe 1985, 99), but the last of these was abandoned due to lack of resources.

Wheeler's principal conclusions for the Neolithic period on the site were confirmed and refined. The main contributions of the project can be summarised as follows.

Earthwork survey emphasised the tripartite character of the long mound, and raised the possibility that a north-east to south-west earthwork running into the west hillfort entrance may originally have been a freestanding cross-ridge dyke (Balaam *et al*. 1991, 38, 40–1, fig. 29; Sharples 1991a, fig. 33: phase 4).

Geophysical survey revealed an undated enclosure some 60 m west of the causewayed circuits but within the hillfort, at the head of the dry valley between the two knolls of the hill. This is ovoid as far as its course can be traced, measures 40 by 45 m, may have a single entrance, and falls within an area of low magnetic susceptibility and low phosphate values (Balaam *et al*. 1991, figs 30–2). This observation suggests it dates to the intensive first millennium cal BC occupation of the hill, from which most of the magnetic susceptibility and phosphate readings are likely to derive, since, had it been out of use by the Iron Age, the readings would have been more uniform.

Earthwork and magnetometer survey also identified a possible round barrow, in addition to the one already known on the hill, to the north of the long mound in the centre of the hillfort (Balaam *et al*. 1991, 40–1, fig. 29: M).

The excavation made it clear that the wealth of finds from the inner causewayed ditch was concentrated in the upper fills, in charcoal-rich 'midden' layers, which had entered the ditch from the exterior, interleaved with

Table 4.9. Radiocarbon dates from Maiden Castle, Dorset. Posterior density estimates derive from the model defined in Figs 4.41–5.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Inner ditch									
GrA-29112	401 299/A	Cattle-sized animal. Rib fragment	Trench I. Context 299. One of fills of feature 2233, which was cut by inner ditch 2235, above 2183 (Sharples 1991a, fig. 49)	4785±40	−21.8			3650–3380	*3645–3545*
OxA-14834	401 299/B	Sheep/goat. R mandible fragment, adult, with accessory mental foramen below P2	Trench I. Context 299. One of fills of feature 2233, which was cut by inner ditch 2235, above 2183 (Sharples 1991a, fig. 49)	4734±35	−21.7			3640–3370	*3635–3555*
GrA-29744	401 141 A	Single fragment of Pomoideae	Trench I. Context 141 (subdivision of 140). Layer immediately above initial silt (Sharples 1991a, fig. 51)	4825±40	−24.5			3700–3520	*3565–3535*
OxA-15096	401 141 B	Single fragment of *Corylus* sp.	From the same context as GrA-29744	4303±30	−24.5			3010–2880	
GrA-29743	401 215 A	Single fragment of *Quercus* sp. roundwood	Trench I. Context 215 (subdivision of 140). Layer immediately above initial silt (Sharples 1991a, fig. 51)	4825±40	−26.3			3700–3520	*3565–3535*
OxA-15097	401 215 B	Single fragment of *Quercus* sp. sapwood	From the same context as GrA-29743	4868±33	−26.0			3710–3540	*3710–3630* (93%) or *3555–3540* (2%)
OxA-1148	401 14577	Human. Bone from articulated burial of a 3–4 year-old child. Replicate of OxA-14832	Trench I. Context 215 (subdivision of 140). In top of rubble layer 140 which immediately overlay the initial fine silts (Sharples 1991a, fig. 51 — the skull of this skeleton is shown at the SW (left) end of the section, but is not labelled)	4810±80			4874±32 T′=0.8; T′(5%)=3.8; ν=1	3710–3630	*3560–3535*
OxA-14832	401 14577/A	Human. Humerus from articulated burial of a 3–4 year-old child. Replicate of OxA-1148	From the same context as OxA-1148	4886±35	−20.2	10.9			
BM-2449	401 14565	*Quercus* sp., mature (Sharples and Clark 1991, 104)	Trench I. Context 2169. Chalk rubble layer approx. 0.30 m above base of ditch, below 2164, in upper part of chalk rubble fills (Sharples 1991a, fig. 49)	5040±60	−25.4			3970–3670	*3965–3705*
BM-2450	401 14565	*Quercus* sp., mature (Sharples and Clark 1991, 104)	From the same context as BM-2449	5020±50	−23.5		5032±38 T′=0.1; T′(5%)=3.8; ν=1	3960–3700	*3950–3755* (88%) or *3745–3710* (7%)
BM-2450A	401 14565	*Quercus* sp., mature (Sharples and Clark 1991, 104). Recount of same sample as BM-2450	From the same context as BM-2449	5050±60	−23.5				
OxA-14835	401 2180	Sheep/goat. 2 possibly articulating lumbar vertebrae	Trench I. Context 2180 (subdivision of 2206). Chalk rubble layer at equivalent level to 2169. Did not extend into section (Sharples 1991a, fig. 49)	4796±36	−22.2			3650–3510	*3565–3535*
GrA-29143	401 2180 vessel 4040	Internal residue from 1 of a few sherds from a Neolithic Bowl, found together	From the same context as OxA-14835	4920±45	−28.8			3790–3630	*3790–3635*
GrA-29109	401 136	Cattle. Unfused L(?) distal metacarpal shaft end and fitting epiphyses	Trench I. Context 136 (subdivision of 130). Layer overlying 140 (Sharples 1991a, fig. 51). The articulation of the bones shows that they were still connected by tendons when buried so that the animal from which they came was then not long dead	4860±40	−22.4			3710–3530	*3555–3535*
BM-2448	401 14558	Cattle. L. tibia. Surface condition good. Distal, midshaft and proximal shaft present, ancient break across proximal end of shaft	Trench I. Context 298. 'Midden' layer above 2206 and below 280, not extending into section	4710±70	−20.3			3650–3350	*3640–3540*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
BM-2447	401 14555	Large ungulate. 4 vertebrae and 1 acetabulum fragment. 1 mature and 1 immature animal represented. Good surface condition. Submission form describes vertebrae as articulated	Trench I. Context 283 (subdivision of layer 280). 'Midden' layer above 281 and below 2157, not extending into section (Sharples 1991a, fig. 49)	4800±45	−20.4			3660–3380	*3655–3535*
GrA-29209	401 284/A	Fresh-looking residue from 1 of 3 sherds from same pot. Replicate of OxA-14733	Trench I. Context 284 (subdivision of 280). 'Midden' layer above 281 and below 2157, not extending into section (Sharples 1991a, fig. 49)	4910±45	−29.1		4957±26 T′=1.65; T′(5%)=3.8; ν=1	3800–3650	*3790–3655*
OxA-14733	401 284/B	Fresh-looking residue from 1 of 3 sherds from same pot. Replicate of GrA-29209	From the same context as GrA-29209	4980±32	−26.2				
GrA-29210	401 2283	Well-preserved internal residue from Neolithic Bowl body sherd	From the same context as GrA-29209	4975±40	−28.4			3940–3650	*3935–3875* (*12%*) or *3810–3655* (*83%*)
GrA-29211	401 2284	Abundant fresh internal residue from 1 of >5 conjoining sherds of a Neolithic Bowl	From the same context as GrA-29209	4885±40	−28.3			3750–3630	*3765–3630* (*94%*) or *3555–3540* (*1%*)
GrA-29107	401 2205	Cattle. Distal R tibia fragment (fused) and astragalus, possibly articulating, although surface condition of two bones different	Trench I. Context 2205 (subdivision of 280). 'Midden' layer above 281 and below 2157, not extending into section (Sharples 1991a, fig. 49)	4755±40	−22.1			3640–3370	*3555–3530*
OxA-X-2135-46	401 2336	Residue from 1 lower corner of 1 wall sherd from substantially represented gabbroic vessel, formed of AOR 2336 (context 291) and rim sherd AOR 2321 (from later context 277) (Cleal 1991, fig. 141:4, microfiche M9:C4–C5)	Trench I. Inner ditch, context 291. Loam intercalated with 'midden' layers, not extending into sections, above 296 and below 293	4880±65	−27.5			3790–3520	*3800–3620* (*81%*) or *3610–3535* (*14%*)
OxA-14833	401 291	Pig. Lumbar vertebra with fitting unfused epiphysis	From the same context as OxA-X-2135-46	4804±37	−20.6			3660–3520	*3555–3525*
OxA-14792	401 109	Internal residue from Neolithic Bowl body sherd	Trench I. Context 109 (subdivision of 98). Lower horizon of pre-long mound soil in ditch top (Sharples 1991a, fig. 51)	4922±39	−28.0			3790–3640	*3780–3640*
OxA-1147	401 14575	Cattle, femur	From the same context as OxA-14792	4690±80				3650–3190	*3645–3530*
OxA-1337	401 14557	Pig. Humerus	Trench II/A. Context 560. Primary silt, on ditch bottom, ?= 559, not extending into section (Sharples 1991a, fig. 59)	5030±80				3980–3640	*3970–3655*
OxA-1144	401 14563	Large ungulate. Thoracic vertebra, probably red deer. Replicate of GrA-29108	Trench II/A. Context 554. Rubble fill overlying primary silt 570 (Sharples 1991a, fig. 59)	4550±80			4846±36 T′=16.2; T′(5%)=3.8; ν=1		
GrA-29108	401 14563/A	Large ungulate. Thoracic vertebra, probably red deer. Replicate of OxA-1144	From the same context as OxA-1144	4915±40	−21.8			3780–3630	*3775–3640*
GrA-29207	401 553/A	Fresh internal residue from 1 of 2 Neolithic Bowl sherds. Replicate of OxA-14734	Trench II/A. Context 553. Lowest charcoal-rich 'midden' layer over 568 and under 550 (Sharples 1991a, fig. 59). The fresh condition of the residue suggests that the pot was freshly broken when the sherds were deposited	4935±45	−28.8		4867±27 T′=3.6; T′(5%)=3.8; ν=1	3710–3630	*3705–3635*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-14734	401 553/B	Fresh internal residue from 1 of 2 Neolithic Bowl sherds. Replicate of GrA-29207	Trench II/A. Context 553. Lowest charcoal-rich 'midden' layer over 568 and under 550 (Sharples 1991a, fig. 59). The fresh condition of the residue suggests that the pot was freshly broken when the sherds were deposited	4830±33	−26.2				
GrA-29111	401 567	Cattle. Proximal femur fragment and unfused epiphysis, probably fitting	Trench II/A. Context 567. 'Midden' layer over 553 and under 550 (Sharples 1991a, fig. 59)	4815±40	−21.8			3660–3520	*3555–3530*
BM-2454	401 14562	Cattle. R. metatarsal and R. ilium and part of acetabulum. Condition good, slight gnawing on ilium	From the same context as GrA-29111	4830±60	−20.8			3710–3380	*3715–3530*
OxA-1143	401 14579	Cattle. Radius	Trench II/A. Context 568. Clay silt between 'midden' deposits 552 and 551 (Sharples 1991a, fig. 59)	4730±80				3660–3350	*3660–3530*
OxA-1142	401 14553	Cattle. R. metacarpal	Trench II/A. Context 541. One of topmost fills of ditch, above 557, below 529 (Sharples 1991a, fig. 59)	4750±80				3700–3360	*3695–3675* (2%) or *3665–3530* (93%)
OxA-1141	401 14582	Cattle. ?*Primigenius* metacarpal	Trench II/A. Context 530 (subdivision of 529). One of topmost fills of ditch, above 537, below 523 (Sharples 1991a, fig. 59). LNEBA sherds present (Cleal 1991, table 143)	4360±80				3340–2870	
Long mound									
GrA-29146	401 1102	Red deer. Beam chopped off above and below broken trez tine. Max dimension 1700 mm (description from Armour-Chelu archive in NHM)	Trench III. Context 810. Initial fill, on base of ditch (Sharples 1991a, fig. 57)	4710±45	−23.2			3640–3360	*3540–3495* (38%) or *3470–3380* (57%)
OxA-14838	401 1133	Red deer. Antler crown 'rake' with three worn tines. Cut-marks around stump of beam	Trench III. Context 991 (lowest fill of pit 2276). Pit cut into primary fills of N long mound ditch, W of causeway, cutting clay layer 2262 which overlay the ditch bottom (Sharples 1991a, figs 56–7). Among antler fragments on floor of pit (Sharples n.d., 33)	4674±35	−20.8			3630–3360	*3530–3485* (28%) or *3465–3365* (67%)
GrA-29147	401 1131	Red deer. Shed antler with parts of bow tine, part of trez tine, max dimension 440 mm. Burr very worn, ?used as hammer. Brow tine detached. Small areas of burning between brow and trez tine and around trez tine. Brow tine detached. Antler chopped through above trez tine (description from Armour-Chelu archive in NHM)	From the same context as OxA-14838	4740±45	−22.7			3640–3370	*3535–3490* (29%) or *3450–3370* (66%)
OxA-1145	401 14591 = AOR 1134	Red deer. Antler. Two tines survive in box 7, suggesting that a substantial part of the antler was present. The original finds record reads 'fair, broken, fractured, 5 pieces'	From the same context as OxA-14838	4660±80				3640–3120	*3535–3475* (30%) or *3465–3365* (65%)
OxA-1349	401 14507	Red deer. Antler. Relatively small quantity of antler remaining after AMS date suggests that it was a fragment rather than a semi-complete antler	Trench III. Context 851. Fill of tentatively identified pit 849, largely removed during Wheeler's excavation, apparently cut into primary fill of ditch	4660±80				3640–3120	*3530–3475* (29%) or *3470–3365* (66%)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-29336	ARC 1970 3054/B	Red deer. Recently broken fragments of antler beam and tine with worn tip	Wheeler's site Q, trench p 49. Object marked 'MC Q trench p 49 ext layer 6 black occ 15/10/37'. I.e. site Q, trench p 49 extension, layer 6, dark 'occupation deposit'. Wheeler's site Q occupied the south side of the east end of the long mound (Wheeler 1943, pl. IV). Trench p 49 was in the east terminal of the south ditch of the mound (Cleal 1991, fig. 147). The marking on the object corresponds to the 'Black hearth-layer immediately over the rapid silt' in that terminal, which also contained cattle skulls (Wheeler 1943, 88)	4755±45	−21.2			3650–3370	*3540–3495* (*32%*) or *3445–3375* (*63%*)
OxA-14831	ARC 1970 3054/A	Red deer. Large antler tine with worn tip. Fresh break at proximal end.	Wheeler's site Q, trench p 49. Box marked 'MC Q trench p 49 ext layer (6) dark occ'. I.e. the same context as GrA-29336	4783±35	−20.8			3650–3380	*3540–3500* (*34%*) or *3430–3375* (*61%*)
OxA-1146	401 14571	Red deer. Mature atlas	Trench I. Context 2209. Overlying primary silts 2210, 2224, under 2215, Out of range of slumps from causewayed enclosure ditch (Sharples 1991a, fig. 46)	4650±80				3640–3100	*3635–3385*
OxA-14881	401 828	Fresh looking internal residue from 2 of 3 small sherds	Trench III. Context 828. Above primary fill 810 in central part of N ditch of long mound (Sharples 1991a, fig. 57)	2300±28	−26.8			410–260	
BM-2456	401 14543	Red deer. L. tibia. Good condition	Trench III. Context 2263. Central section of long mound. On N side of N ditch, above 2267 (Sharples 1991a, fig. 57)	4720±100	−20.9			3700–3130	*3695–3675* (*1%*) or *3665–3375* (*94%*)
OxA-1576	401 14589	Cattle. Lumbar vertebra	Trench III. Context 2268. Central section of long mound. Layer immediately overlying primary fill in N ditch (Sharples 1991a, fig. 57)	4790±100	−21.0			3780–3360	*3770–3380*
OxA-1341	401 14549	Unidentified charcoal	Trench III. Context 985 (subdivision of 984). Central section of long mound. Layer immediately overlying 2268 in N ditch (Sharples 1991a, fig. 57)	4460±80				3370–2900	
BM-2455	401 14570	Cattle. R femur, good condition	Trench III. Context 983 (subdivision of 954). Middle fill of long mound ditch, above 984, below 937 (Sharples 1991a, fig. 57). Beaker sherds present (Cleal 1991, table 142)	3470±70	−21.9			1960–1610	
BM-458	Skeleton Q1	Human. Male skeleton, 25–35 years, found articulated but dismembered, with severe cuts to skull. '. . . approximately 100 gm. of bone was drilled from the right femur'	From mutilated skeleton found in long mound approx. 25 m from E end (Wheeler 1943, pls XLI–XLIII), originally thought to be primary and Neolithic. Date was obtained because injuries appeared to have been inflicted by a metal blade (Brothwell 1971)	1315±80				cal AD 590–890	
Outer ditch									
GrA-29113	401 2030	Sheep. Base of R horncore with attached skull fragment	Trench II/A. Context 324. Basal fill of truncated ditch. Associated with disarticulated human bone and other disarticulated animal bone (Sharples 1991a, figs 50, 54)	4775±40	−21.6			3650–3380	*3640–3535*
BM-2452	401 2012	Cattle. R. tibia, in good condition	From the same context as GrA-29113	4640±50	−21.5			3630–3340	*3635–3555*
BM-2451	401 2010	Human. Disarticulated L femur	From the same context as GrA-29113	4860±70	−20.4			3790–3510	*3785–3535*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-14794	401 1580	Slight internal residue from small Neolithic Bowl body sherd (in 2 recently broken fragments)	From the same context as GrA-29113	4806±36	−25.5			3660–3520	*3655–3615* (*28%*) or *3610–3530* (*67%*)
OxA-1338	401 2011	Human. Femur, disarticulated	From the same context as GrA-29113	4930±90				3960–3520	*3950–3625* (*91%*) or *3580–3540* (*4%*)
OxA-14837	401 2026	Human. Mandible from 3–5 year-old	From the same context as GrA-29113	4794±38	−20.6	9.2		3650–3390	*3650–3535*
OxA-1339	401 13510	Large ungulate. Rib	Trench V/F. Context 7014. Silt overlying ditch floor (Sharples 1991a, fig. 53)	4740±80				3660–3350	*3695–3680* (*1%*) or *3665–3530* (*94%*)
OxA-1340	401 13511	Cattle. L mandible	From the same context as OxA-1339	4650±70				3640–3120	*3640–3540*
GrA-29120	401 7014 18/19	Cattle. L mandible. Comparison with the remainder of the sample for OxA-1340 shows that this cannot be part of the same L mandible. The remainder is from a larger jaw	From the same context as OxA-1339	4795±40	−22.0			3660–3380	*3650–3535*
GrA-29213	401 7850/A	Residue from 5 sherds, extracted from a larger group all from same Neolithic Bowl. Recorded in field as single sherd. Replicate of OxA-14793	Trench V/F. Context 7013. Large chalk blocks overlying 7014, apparently deliberately laid (Sharples 1991a, fig. 53)	4605±40	−29.5		4712±31 T′=17.2; T′(5%)=3.8; ν=1	3500–3130	
OxA-14793	401 7850/B	Residue from 5 sherds, extracted from a larger group all from same Neolithic Bowl. Recorded in field as single sherd. Replicate of GrA-29213	From the same context as GrA-29213	4870±50	−28.6			3760–3530	
OxA-14836	401 7012 2/30	Cattle. Cervical vertebra, cut-marked	Trench V/F. Context 7012. Apparent backfill of unweathered ditch, overlying 7013	4819±34	−22.0			3660–3520	*3665–3620* (*37%*) or *3605–3530* (*58%*)
GrA-29145	401 7012 1/30	Cattle. 2 rib fragments with longitudinal cut-marks from filleting	From the same context as OxA-14836	4905±45	−22.0			3780–3630	*3780–3635*
Inter-ditch bank									
BM-2453	401 12453, 14509	*Quercus* sp. charcoal	Trench II/A. Context 520 (subdivision of 435). Palaeosol beneath bank lying between two Neolithic ditches	14310±100	−25.2			15630–14640	
OxA-1336	401 14508	Cattle. Innominate	Trench II/A. Context 511 (subdivision of 509). From bank between inner and outer causewayed ditches (Sharples 1991a, figs 59–60)	4570±80				3630–3020	

equally finds-rich loams, which lacked any concentration of charcoal and had entered the ditch from the interior (Sharples 1991a, 51, figs 50 and 59: context 550, fig. 51: context 236). It also confirmed that a soil horizon had developed on top of the ditch fills by the time the long mound was built (Fig. 4.30; Sharples 1991a, 51).

The very different character of the outer ditch in the eastern entrance was confirmed. The relatively uniform and finds-poor rubble fills and steep, unweathered sides suggest it was backfilled soon after excavation (Fig. 4.30: section C; Sharples 1991a, 52, figs 43, 53, 98).

The small bank between the two ditches proved to postdate the original monument rather than to be a part of it, since there was a sherd of Peterborough Ware on the surface beneath it and a disarticulated animal bone sample from it (Fig. 4.44: *OxA-1336*) was later than other samples from the lower levels of the adjacent inner and outer ditches (Sharples 1991a, 57).

Sharples pointed out that Wheeler may have encountered a third, outermost Neolithic ditch, 30 m outside the known outer ditch, underlying the tail of the expanded hornwork in the east hillfort entrance (Sharples 1991a, 50; Wheeler 1943, pls XII, CXIX). The ditch was largely silted by the time an infant was buried in the top of it, with 'Iron Age A' sherds (Morant and Goodman 1943, 347). It has not been possible to locate any potential samples from it. The strongest argument for a Neolithic date is its flat-bottomed, steep-sided profile, which corresponds to those of the Neolithic ditches on the hill and contrasts with the blunted V-profile of the Iron Age ditches on the site (Wheeler 1943, pls VI, IX, XI, XIII, XIX; Sharples 1991a, fig. 50), an observation which can be replicated more widely on the Wessex Chalk. Sharples also noted that Wheeler had recorded a 'Neolithic mound' of unknown extent yet farther east under the outworks of that entrance (Wheeler 1943, pl. XIII).

Early Neolithic pits, previously confined to the eastern hillfort entrance and the east end of the long mound, were shown to extend to the south-west of the hillfort, where an example was found in Trench IV (Sharples 1991a, 53).

Cuttings across the north ditch of the long mound (Fig. 4.30: section B; Sharples 1991a, figs 49, 57) showed the same symmetrical silting as Wheeler's single published section (1943, fig. 15), reflecting the presence of a berm at least 2 m wide between mound and ditches (Sharples 1991a, fig. 46). In Trench III, the larger of these cuttings, at least three and probably four pits had been cut into the base of the ditch after very little silt had accumulated (Sharples 1991a, figs 56–7). Sharples has suggested that they may have formed part of a pit circle extending beyond the ditch.

The manufacture of flint axeheads and other large core tools on the site was confirmed by the identification of thinning, mass reduction and retouch flakes. The absence of comparable features from other assemblages from the surrounding area strongly suggests that axehead-making was focused at Maiden Castle, despite the wide availability of suitable raw material (Edmonds and Bellamy 1991, 218, 227–9).

In addition to the bank between the two ditches, there were further hints of third or second millennium cal BC modification of the earthworks. In Trench II, next to that bank, a hollow cut into the inner ditch edge and the ditch top contained sherds of Peterborough Ware and Beaker (Sharples 1991a, 57, fig. 59: 536–7, 541; Cleal 1991, tables 140, 142, microfiche M9: D10, D13). Over on the east side of the enclosure in Trench VI, what had appeared to be a remnant of the outer ditch, severely truncated by one of the Iron Age ditches (Wheeler 1943, pl. XI), proved to consist of fragments of two adjacent but essentially separate features (Sharples 1991a, fig. 98). The deeper of these, 7122, was almost certainly the outer Neolithic ditch and contained a woodland molluscan fauna. The other, 7073, however, contained an open-country molluscan fauna (Evans and Rouse 1991, 120), which would accord with what is known of the late third and second millennium cal BC vegetation of the site.

Neolithic activity at Maiden Castle has been placed in its local context not only by the landscape survey which formed part of the 1985–6 project but also by the immediately adjacent large-scale investigations of the South Dorset Ridgeway project (P. Woodward 1991) and the Dorchester Bypass project (R. Smith *et al*. 1997). Together these have shown that there was probably more tree cover on Maiden Castle during the construction and use of the enclosure than there was on the lower-lying, more lived-in land to the north (J. Evans *et al*. 1988; M. Allen 1997a, table 78, fig. 120). They have also delineated a possible catchment for the site, by showing that early Neolithic artefacts, most readily interpreted as representing settlement, are locally least rare in the South Winterborne valley, immediately to the south of Maiden Castle and at other restricted locations ringing the present area of Dorchester, including the Frome valley, Conygar Hill and the area of the Bridport Road Ridge. All these are potential sources of the Tertiary gravel flint which was brought to Maiden Castle, probably in the form of prepared cores (Healy 1997c; Edmonds and Bellamy 1997).

Subsequent to the 1985–6 project, Paul Martin considered the question of whether Maiden Castle was defended in the Neolithic (2001). In favour of the possibility, he found (1) that most of the leaf arrowheads surviving from the Wheeler excavations had indeed been hafted, on the evidence of microscopic traces of organic residues, which could be from adhesives such as birch bark tar; (2) that if, following the results of experiments by others, both proximal and distal breakage to an arrowhead can result from impact, then the frequency of both at Maiden Castle (Wheeler 1943, figs 42–3; Edmonds and Bellamy 1991, fig. 178) could reflect their use as weapons; (3) that 13 of the 24 leaf arrowheads which could be located with any precision were concentrated where the long mound crosses the west side of the enclosure, the others being more scattered (P. Martin 2001, appendix 13);[4] (4) that the topography makes the enclosure most easily attacked from the west, where there is no slope up to it, i.e. in this part of the circuit (P. Martin 2001, appendix 18); and (5) that the

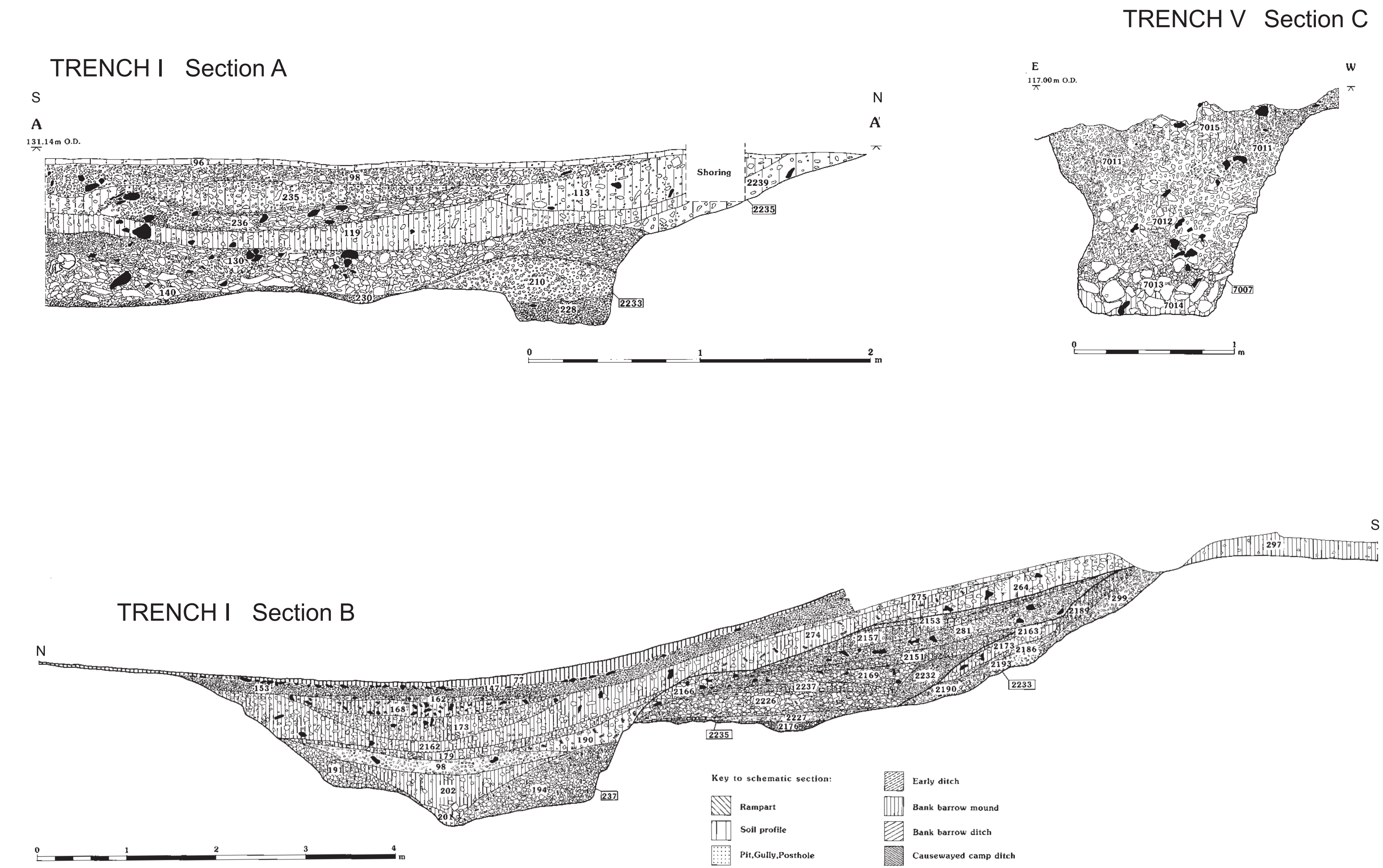


Fig. 4.30. Maiden Castle. A: west face of Trench I showing inner causewayed enclosure ditch. B: east face of Trench I showing inner causewayed enclosure ditch cut by north ditch of long mound. C: north face of Trench V showing outer causewayed enclosure ditch. Note that the inner enclosure ditch in Trench I was sectioned obliquely and the Long Mound ditch at right-angles. The locations of the sections are shown in Fig. 4.29. After Sharples (1991a, figs 51, 49, 53).

Fig. 4.31. Maiden Castle. Wheeler and some of his team in 1937. Dorset County Museum MC 124b, neg cc83/1203.

Fig. 4.32. Maiden Castle. North ditch of the long mound on site L in 1936. Dorset County Museum MC 265 neg cc83/1006.

concentration of arrowheads coincided with chalk rubble fills characterised by 'considerable quantities of charcoal, largely mature oak, which was at least partially created by a fire which had scorched many of the chalk blocks' (Sharples 1991a, 51), which might have derived from the burning of the timber-framed bank. Against the possibility of defence and attack was the vertical distribution of the arrowheads in this area, some of which came from the inner ditch and others from the turfline beneath the long mound, suggesting that they had accumulated over a period of time. Largely for this reason, Martin remained undecided as to whether the arrows reflected conflict, formed a part of the overall pattern of deposition at the site, or both. It is possible that most of them might derive from a single episode, some progressively entering the ditch from the surrounding surface. Given the limited extent of excavation in the area, the boundaries of the concentration remain to be defined. Roger Mercer (2006a; 2006b) has also emphasised this evidence, noting amongst others the arrowheads found by Wheeler in the ditch in the immediate vicinity of the eastern entrance.

Previous dating

Twenty-six radiocarbon dates were obtained following the 1985–6 project (Fig. 4.33; Ambers *et al*. 1991). Samples were submitted only where it was judged that there was a secure link between the sample and the formation of the context in which it was located. For animal bone, this meant that the samples favoured for dating were substantial and in good condition.

One date on oak charcoal, from the palaeosol beneath the bank between the two Neolithic ditches, falls bizarrely within the upper Palaeolithic (14310±100 BP; BM-2453. This 'obviously aberrant' measurement (Ambers *et al*. 1991, 104) is not included in the present analysis. The remainder were interpreted by Sharples and Clark (Sharples 1991a, 104–5) as showing that: the enclosure was built between 3900 and 3700 cal BC; the 'midden' layers in the upper fills of the inner ditch were deposited *c*. 3700 cal BC; the outer ditch was backfilled at a date between 3700 and 3350 cal BC; the long mound was built by *c*. 3350 cal BC; and reoccupation of the hilltop began between 3350 and 3100 cal BC, continuing into the second millennium.

Barclay and Bayliss modelled the dates from the inner ditch in Trenches I and II and from the long mound in an attempt to determine the date of the latter, estimating a construction date for the long mound of *3520–3200 cal BC* (*95% probability*; Barclay and Bayliss 1999, fig. 2.4: *const_Maiden_Castle*).

Rosamund Cleal argued (2004, 169, 188) that the chronology of Sharples and Clark was too long. For the inner ditch, she treated OxA-1337 (on a disarticulated animal bone) from Trench II as a *terminus post quem* for the initial fine silts and BM-2449–50 (both on mature oak charcoal) from Trench I as *termini post quos* for the rubble layers. Like Sharples and Clark, and Barclay and Bayliss, she dismissed OxA-1144, stratified below three older determinations in Trench II (OxA-1142–3, BM-2454), as anomalous. This left OxA-1148, on a sample from an articulated human child skeleton in the top of rubble layer 140, the skull of which is shown at the SW (left) end of the relevant section (Fig. 4.30: section A; Sharples 1991a, fig. 51). Given that, on the evidence of the Overton Down experimental earthwork, the underlying 0.30 m or so of silt and rubble could have accumulated over at most 25 years, she suggested that this date, of 3760–3370 cal BC, is only very slightly later than the construction of the inner circuit.

For the outer ditch, where all the available measurements were on disarticulated bone from the initial silts, Cleal treated the two human bone samples (Fig. 4.33: OxA-1338, BM-2451) from a deposit of cultural material in Trench II (Sharples 1991a, fig. 54) as redeposited, because they were older than the one available measurement on animal bone from the same context (Fig. 4.33: BM-2452), while this animal bone date is comparable to the two dates for animal bone samples from the base of the same ditch in Trench V (Fig. 4.33: OxA-1339–40). These last three dates, of 3630–3140, 3660–3350 and 3650–3100 cal BC (95% confidence; Table 4.9), could thus provide *termini post quos* for the construction of the outer circuit. These logical conclusions suggested that the whole enclosure could have been younger than Sharples and Clark proposed and that the inner circuit could have pre-dated the outer. They also emphasised the extent to which redeposition can bias a set of measurements made almost entirely on disarticulated bone (in two cases bulked) and on charcoal that was either of oak or unidentified.

Reassessment and modelling of existing dates

In Figs 4.34–7, the existing dates are modelled in more precise stratigraphic order than by Barclay and Bayliss, essentially following Cleal's evaluation of the dates. The emptying and expansion of Wheeler's trenches preclude detailed stratigraphic links between opposed faces of a single cutting, the intervening deposits having been excavated in the 1930s. The model does not assume that there is a stratigraphic relationship between the outer circuit and the long mound.

The inner ditch (Fig. 4.35). The only sample from the initial fine silts (Fig. 4.35: *OxA-1337* from Trench II) is treated as a *terminus post quem* for the overlying rubble fills of the inner ditch because the sample was disarticulated, as was that for OxA-1144 in those overlying rubble fills. The latter is regarded as anomalous, as it was by previous writers, because it is more recent than the only articulated sample from the rubble fills (*OxA-1148* from Trench I; T'=5.3; T'(5%)=3.8; ν=1) and, less convincingly, more recent than disarticulated samples stratified above it in Trench II (Fig. 4.35: *BM-2454*, *OxA-1143*). In Trench I, measurements on bulk samples of mature oak charcoal (Fig. 4.35: *BM-2449, 14565*) are treated as *termini post quos* for the rubble fills, leaving *OxA-1148*, measured on an articulated child burial, as the only sample from these layers which can confidently

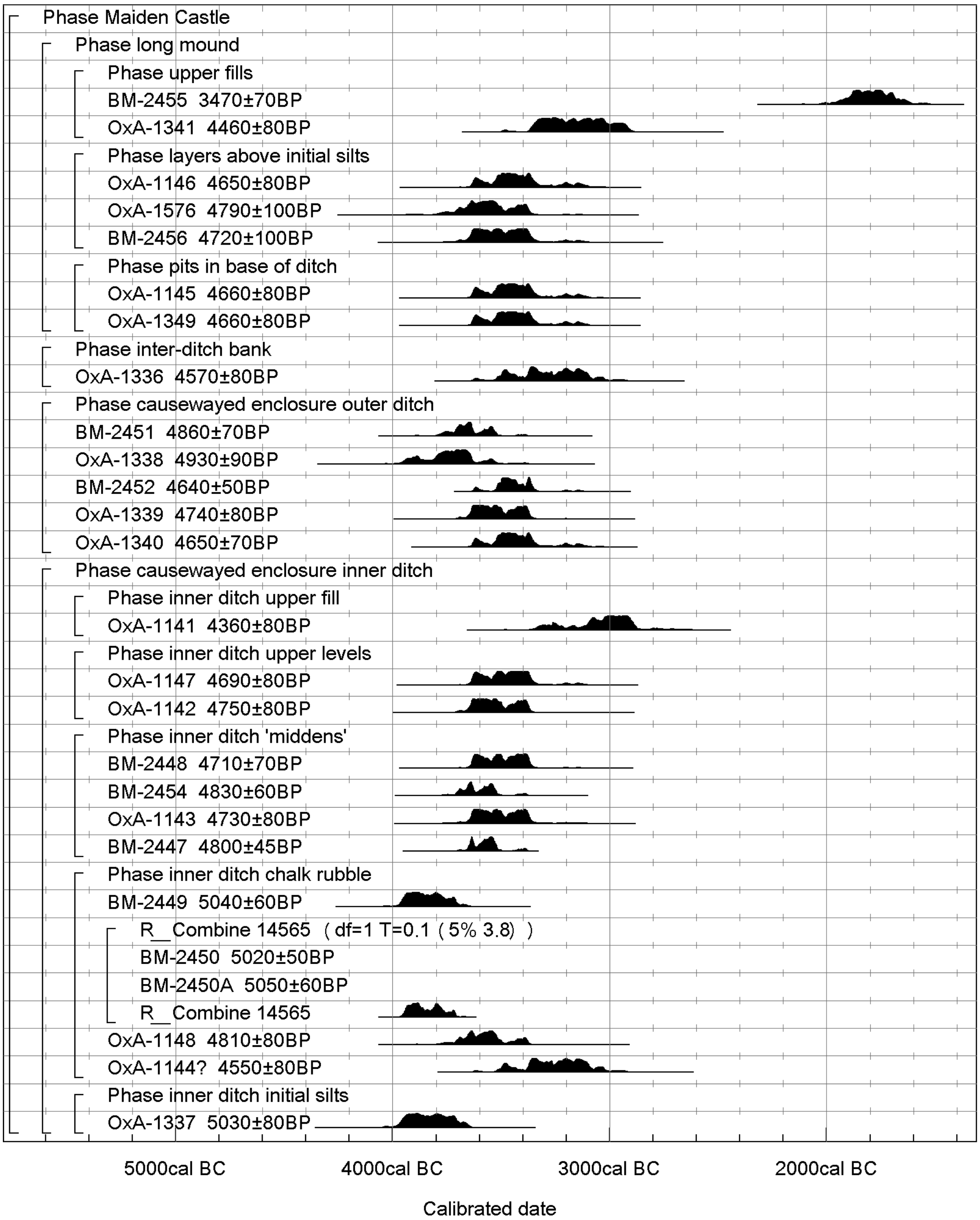


Fig. 4.33. Maiden Castle. Probability distributions of calibrated radiocarbon dates obtained before 1991 from the causewayed enclosure and long mound.

be seen as contemporary with its context. The four samples from the overlying 'midden' layers were disarticulated and two of them (Fig. 4.35: *BM-2447*, *-2454*) were bulked, although that for BM-2447 included articulated material. They are all treated as *termini post quos* for the overlying contexts, as are the two disarticulated samples from the fills overlying the 'midden' deposits (Fig. 4.35: *OxA-1142*, *-1147*). All six measurements, however, are statistically consistent (T'=3.5; T'(5%)=11.1; ν=5), which may suggest that these samples were not in fact from redeposited material and that because they come from more than one context these deposits must have accumulated rapidly.

Construction would have preceded the deposition of the burial dated by *OxA-1148* by an uncertain interval and is estimated to have occurred in *3770–3370 cal BC* (*95% probability*; Fig. 4.35: *build inner*), probably in *3600–3500 cal BC* (*30% probability*) or *3475–3380 cal BC* (*38% probability*). Depending on the rate at which the fill accumulated, the date of construction of the inner ditch could have been closer to the skeleton's date of *3645–3625 cal BC* (*2% probability*; Fig. 4.35: *OxA-1148*) or *3615–3370 cal BC* (*93% probability*), probably of *3565–3500 cal BC* (*32% probability*) or *3450–3375 cal BC* (*36% probability*). A date on a disarticulated animal bone from an upper fill in Trench II (Fig. 4.37: *OxA-1141*) provides a *terminus post quem* for the development of turflines over the inner ditch; it does not relate to the main use of the Neolithic monuments on Maiden Castle.

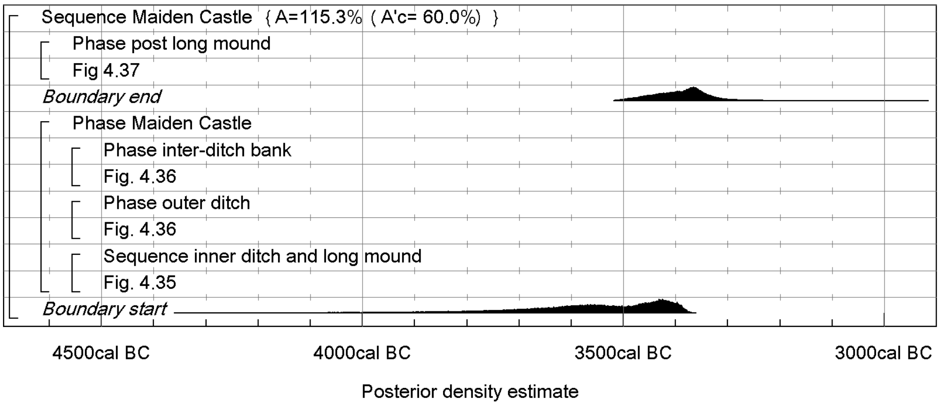


Fig. 4.34. Maiden Castle. Overall structure of the chronological model for the causewayed enclosure and long mound, using radiocarbon determinations obtained before 1991. The component sections of this model are shown in detail in Figs 4.35–7. The format is identical to that of Fig. 4.5. The large square brackets down the left-hand side of Figs 4.34–7, along with the OxCal keywords, define the overall model exactly.

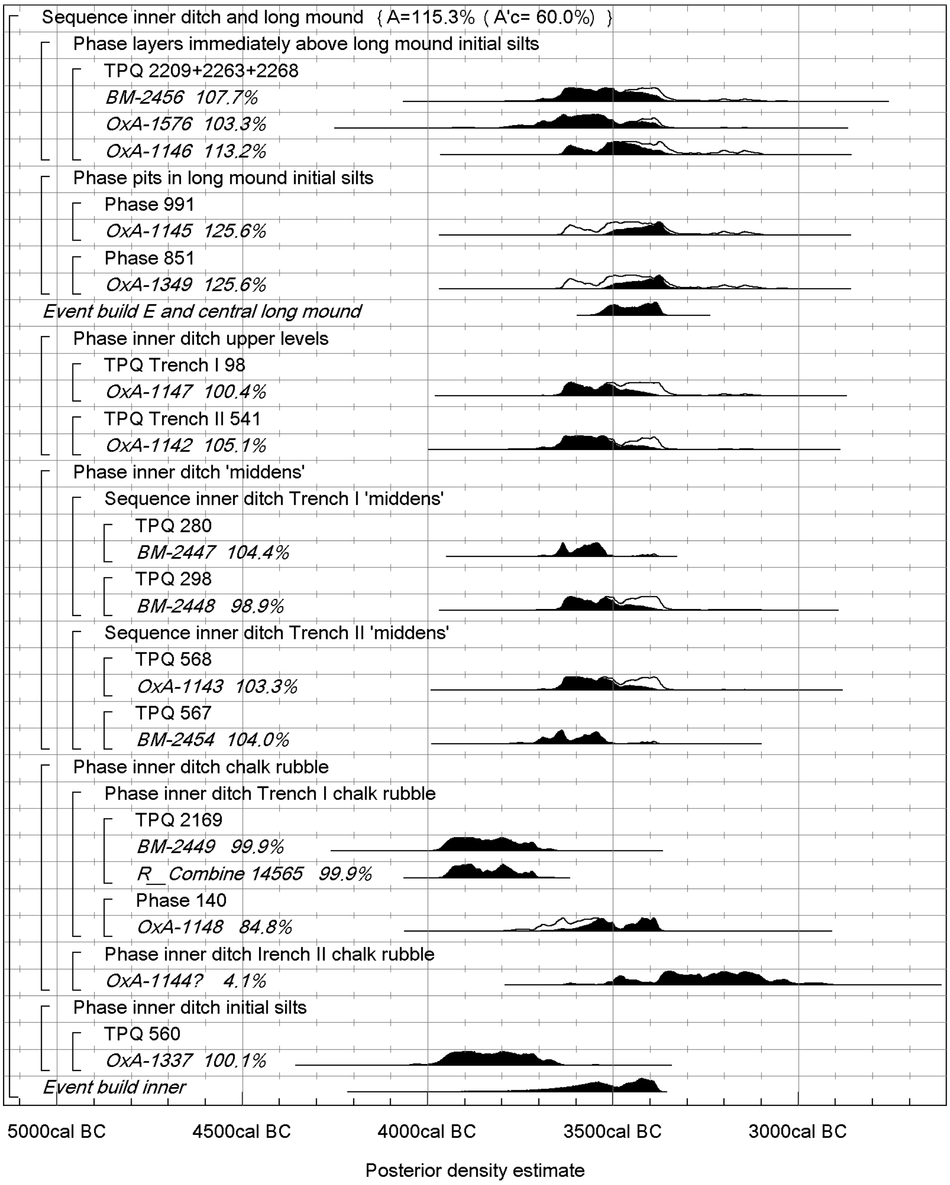


Fig. 4.35. Maiden Castle. Probability distributions of calibrated radiocarbon dates obtained before 1991 for the inner ditch of the causewayed enclosure and long mound. The format is identical to that of Fig. 4.5. The overall structure of this model is shown in Fig. 4.34, and its other components in Figs 4.36–7.

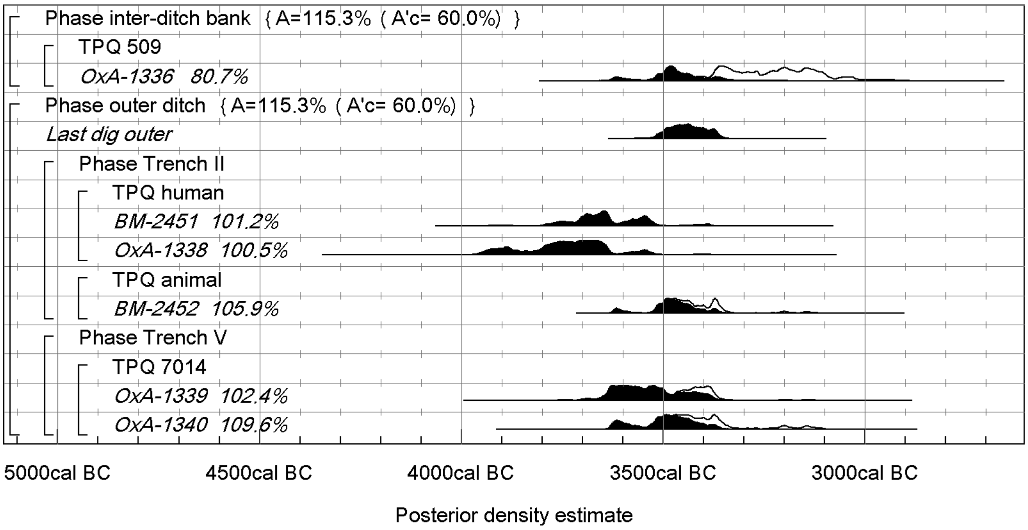


Fig. 4.36. Maiden Castle. Probability distributions of dates from the outer ditch of the causewayed enclosure and inter-ditch bank obtained before 1991. The format is identical to that of Fig. 4.5. The overall structure of this model is shown in Fig. 4.34, and its other components in Figs 4.35 and 4.37.

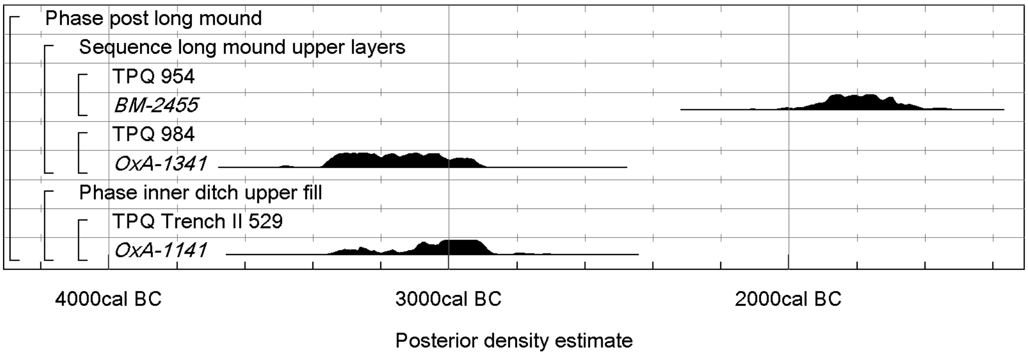


Fig. 4.37. Maiden Castle. Probability distributions of dates from the upper fills of the inner ditch and the long mound obtained before 1991. The format is identical to that of Fig. 4.5. The overall structure of this model is shown in Fig. 4.34, and its other components in Figs 4.35–6.

The long mound (Fig. 4.35). A major question is whether the mound's tripartite form, highlighted by Richard Bradley (1983) and by Balaam *et al*. (1991), reflects successive episodes of construction at either end of a putative original long barrow. Little is known in detail of the western part of the mound, and it is difficult to identify finds from it (Cleal 1991, 183).[5] It is also difficult to define the limits of the central and eastern parts because the features used to distinguish them do not coincide, the break between the most prominent part of the mound and its slighter eastward continuation being some 10 m east of the causeway in its north ditch in Sharples' Trench III (Sharples 1991a, fig. 56). The break in the mound may well be due to the excavation of the first hillfort ditch. If the diminution in size of the mound is taken as the division, BM-2455–6 and OxA-1145, -1341, -1349 and -1576, all from Trench III, would fall in the central part of the mound, and OxA-1146 from Trench I would be the only one of the pre-existing dates to come from the eastward extension. If the causeway in Trench III is taken as the division, OxA-1349 would also come from the extension.

The results of the 1985–6 excavations tend to strengthen the case for contemporaneity between the central and eastern parts of the mound, whether divided by the causeway or by change in size. Within Trench III, pits were cut into the initial silts on both sides of the causeway and the overall similarity of the naturally accumulated fills was such as to prompt the reflection that the hypothetical earlier barrow ditch might have been cleaned out for the construction of the long mound (Sharples 1991a, 55). The only distinction between the two sides of the causeway is the larger size of the ditch in the west face of the trench compared to the east (Sharples 1991a, figs 49, 57). The overall similarity of the fills across Trench III extends to Trench I, which was indubitably in the east part of the mound (Sharples 1991a, figs 36, 49), and to the section published by Wheeler (1943, fig. 15). The only distinction between the long mound ditches in Sharples' two trenches was a difference in the frequency of open country molluscs in the initial silts: 5% in the west face of Trench III, 10% in the east face, and 15% just under 50 m to the east in Trench I, a difference which John Evans and Amanda

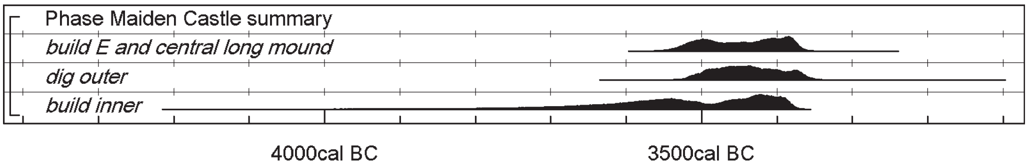


Fig. 4.38. Maiden Castle. Posterior density estimates for the construction of the two circuits of the causewayed enclosure and the eastern and central sections of the long mound, using radiocarbon determinations obtained before 1991, derived from the model shown in Figs 4.34–7.

Rouse saw as natural variation (1991, 124, figs 109, 111, 223, microfiche M5: F1–F2).

The most important stratigraphic consideration is that the eastern part of the long mound was built over the completely silted or infilled inner ditch of the causewayed enclosure.

Five samples came from contexts likely to date from within a few years of the construction of the long mound, consisting of antler from pits cut into the silts immediately overlying the ditch bottom in Trench III (Fig. 4.35: *OxA-1145*, *-1349*) and disarticulated bone from other silts immediately overlying those silts and/or the pits there (Fig. 4.35: *BM-2456*, *OxA-1576*) and in Trench I (*OxA-1146*). The two antler samples may have been used to dig the pits in which they were found, especially as that for *OxA-1145* is likely to have been a pick. The measurements on both antler samples are identical. The three disarticulated samples immediately overlying them are treated as *termini post quos* for the formation of the overlying layers. They are, however, statistically consistent (T'=0.4; T'(5%)=6; ν=2) and so may not be from residual material. Those from Trench III are unlikely to have been derived from the enclosure ditches, and *OxA-1146*, from Trench I, was well clear of the intersection of the long mound and the enclosure ditches (Sharples 1991a, fig. 46).

Above these levels, OxA-1341, on unidentified charcoal, can be taken only as a *terminus post quem* for context 984 as it may suffer from the old-wood effect (Sharples 1991a, fig. 57). This is the context of the earliest occurrence on the site of all-over-cord-impressed Beaker (Cleal 1991, 183), for which the date, of 3370–2900 cal BC, would be exceptionally early. The find in question, however, is a single worn sherd, weighing 1 g and with a surface area of 100 sq mm. Its size and condition make it almost certain that it was intrusive (Cleal 1991, 183), especially as there were four sherds/14 g of the same ceramic, also in worn condition, in the layer above, 954 (Cleal 1991, table 142, microfiche M9:D13). *BM-2455* (Fig. 4.37), a date of 2010–1610 cal BC (Table 4.9) on disarticulated animal bone from 954, provides a *terminus post quem* for that layer.

The pre-existing dates provide an estimated construction date for the east and central parts of the long mound of *3535–3365* (*95% probability*; Fig. 4.35: *build E and central long mound*), probably of *3520–3475 cal BC* (*24% probability*) or *3450–3440 cal BC* (*3% probability*) or *3435–3370 cal BC* (*41% probability*).

The outer ditch (Fig. 4.36). The only dated samples were disarticulated bones from the initial fills, among which the two human samples from Trench II (*BM-2451*, *OxA-1338*) were older than the animal sample from the same context and the two animal samples from Trench V (*BM-2452*, *OxA-1339–40*). The human samples are therefore treated as *termini post quos* for the later filling of the ditch. The construction date has been estimated on the basis that the latest of the disarticulated animal bones in the basal fills of the outer ditch must be closest in date to its digging: *3535–3365* (*95% probability*; Fig. 4.36: *dig outer*), probably *3520–3475 cal BC* (*24% probability*) or *3450–3440 cal BC* (*3% probability*) or *3435–3370 cal BC* (*41% probability*).

The inter-ditch bank. *OxA-1336* (Fig. 4.36), the date of a disarticulated bone from the body of the bank, provides a *terminus post quem* for its construction of *3635–3575 cal BC* (*9% probability*) or *3535–3335 cal BC* (*86% probability*), probably *3620–3610 cal BC* (*1% probability*) or *3520–3420 cal BC* (*66% probability*) or *3375–3365 cal BC* (*1% probability*).

This reanalysis of the existing data suggests that the original estimates for the construction of the enclosure circuits were too early. It now seems more likely that the outer circuit of the enclosure and the central and eastern parts of the long mound were constructed in the 35th century cal BC and the inner ditch in the 36th and 35th century cal BC (Fig. 4.38). However, these estimates are too imprecise to determine the relationship between the outer ditch and the long mound. By calculating the difference between our estimates for the date of construction of the inner circuit of the enclosure and the long mound, we can provide an estimate for how long the inner circuit of the causewayed enclosure was in use. Figure 4.39 suggests that it was in use for a short period of time, probably for less than a century, and perhaps for only a generation or two.

Objectives of the dating programme

Various recurrent questions of chronology, sequence and duration thus apply to Maiden Castle. In addition, specific points which arose at the start of the dating project included the following. Over how long a period did the 'midden' and loam layers in the inner enclosure ditch accumulate? Could the central and eastern sections of the long mound be distinguished? Could the date of the bank between the two ditches and the overall extent of third or second millennium modification of the earthworks be better defined?

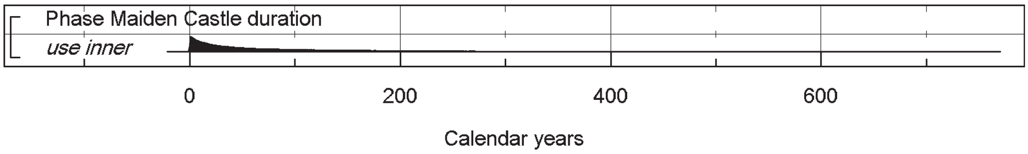


Fig. 4.39. Maiden Castle. Probability distribution of the number of years during which the inner circuit was used, derived from the model defined in Figs 4.34–7.

Sampling strategy and simulation

Based on the preliminary analysis of the existing data, a series of simulations were constructed to determine how many samples would be required from different components of the site in order to refine the chronology of the monument (Fig. 4.40). In addition to statistical criteria, consideration was given to obtaining sequences of samples from more than one of the widely spaced cuttings in each ditch in order to build an archaeologically representative spread of samples. Sample selection was restricted by the uneven survival of the finds, especially the animal bone, from Wheeler's excavations, as well as by the limited extent of Sharples' excavation. Thus, it proved possible to locate new samples from both inner and outer circuits of the enclosure and the long mound ditch, though in varying quantities, but nothing could be located from the possible third circuit on the eastern side of the enclosure, noted above.

Results and calibration

Details of all the radiocarbon measurements from Maiden Castle are provided in Table 4.9.

Analysis and interpretation

Our main model for the chronology of the Maiden Castle enclosure and long mound is shown in Figs 4.41–5. The overall structure of the model is shown in Fig. 4.41. This is constructed on the premise that the use of the Neolithic enclosure circuits forms a basically uninterrupted and continuous phase of activity. There may then be a gap before the construction of the long mound. On stratigraphic grounds, this is later than the inner circuit of the causewayed enclosure. This model counteracts the inevitable statistical scatter on radiocarbon measurements which makes it appear that phases began earlier than they did in reality, and ended later, if no uniform distribution is applied (Buck *et al*. 1992; Steier and Rom 2000; Bronk Ramsey 2000; see Chapter 2.2). It also assumes that the creation of each earthwork was sufficiently rapid for there to be no perceptible lapse of time between the construction of different parts of the monument.

The inner ditch (Fig. 4.42). A fuller stratified sequence of samples was available from Sharples' Trench I than from his Trench II. *Termini post quos* for construction are provided by two fragments of disarticulated animal bone (Fig. 4.42: *GrA-29112*, *OxA-14834*) from context 299, one of the fills of feature 2233, which was cut by the inner ditch in Trench I (Fig. 4.30: section A; Sharples 1991a, fig. 49). The nature of this feature was difficult to determine in a 3.80 m-wide trench; it seems to have run at a different angle to the ditch (Sharples n.d., 12). The sample for *OxA-1337*, from the fine initial silts of the inner ditch in Trench II, was probably redeposited, since it was not only disarticulated but older than the two pre-ditch samples from Trench I. This measurement is therefore used only as *a terminus post quem* for the layers above.

The only sample from the overlying rubble layers in Trench II is a disarticulated vertebra, probably of red deer, which was dated in the 1980s (Table 4.9: OxA-1144). A replicate measurement (Fig. 4.42: *GrA-29108*) was obtained as a check on the original date, which had always seemed anomalously young. The second measurement is indeed older than the first, the two being statistically significantly different (T'=16.2; T'(5%)=3.8; ν=1). It appears that OxA-1144 is inaccurate, and has been excluded from the model. It is apparent that this vertebra was also redeposited, as *GrA-29108* is again earlier than the pre-ditch samples.

The scorched rubble fills in Trench I, with their considerable quantities of charcoal, suggest a burning event in the immediate proximity. Single-entity short-life charcoal samples (*GrA-29743–4,* OxA-15096, *OxA-15097*), extracted from an assemblage that was predominantly of oak (R. Gale 1991b, microfiche M6: C10–C12) were dated to provide a check on the existing mature oak charcoal dates (*BM-2449*, *14565*) from an equivalent context. A possibly articulating animal bone sample (*OxA-14835*) was dated from a layer equivalent to that which had provided the mature oak samples; and a replicate measurement (OxA-14832) was obtained for the articulated child burial (*14577*). Five of the six new measurements are statistically consistent with each other and with the original result on the skeleton (T'=4.4; T'(5%)=11.1; ν=5), and confirm that the mature oak samples were considerably older than their context. The exception, OxA-15096, on a fragment of hazel charcoal, was not only younger than these dates but younger than articulated samples stratified above it (*OxA-14833, GrA-29107, -29109*). A single, small charcoal fragment may have been intrusive and this sample has therefore been excluded from the model. Another of these short-life charcoal samples, *OxA-15097*, appears to be marginally too early for its context (since if it is included in the model as a fresh sample, the overall agreement descends undesirably to $A_{overall}$=57.4% and the probability that this sample actually falls in this place in the stratigraphic sequence is only 2.2%). For this reason, it is treated in the main model as a *terminus post quem* for the overlying contexts. This fragment of charcoal could have been reworked, or this measurement could simply be a statistical outlier,

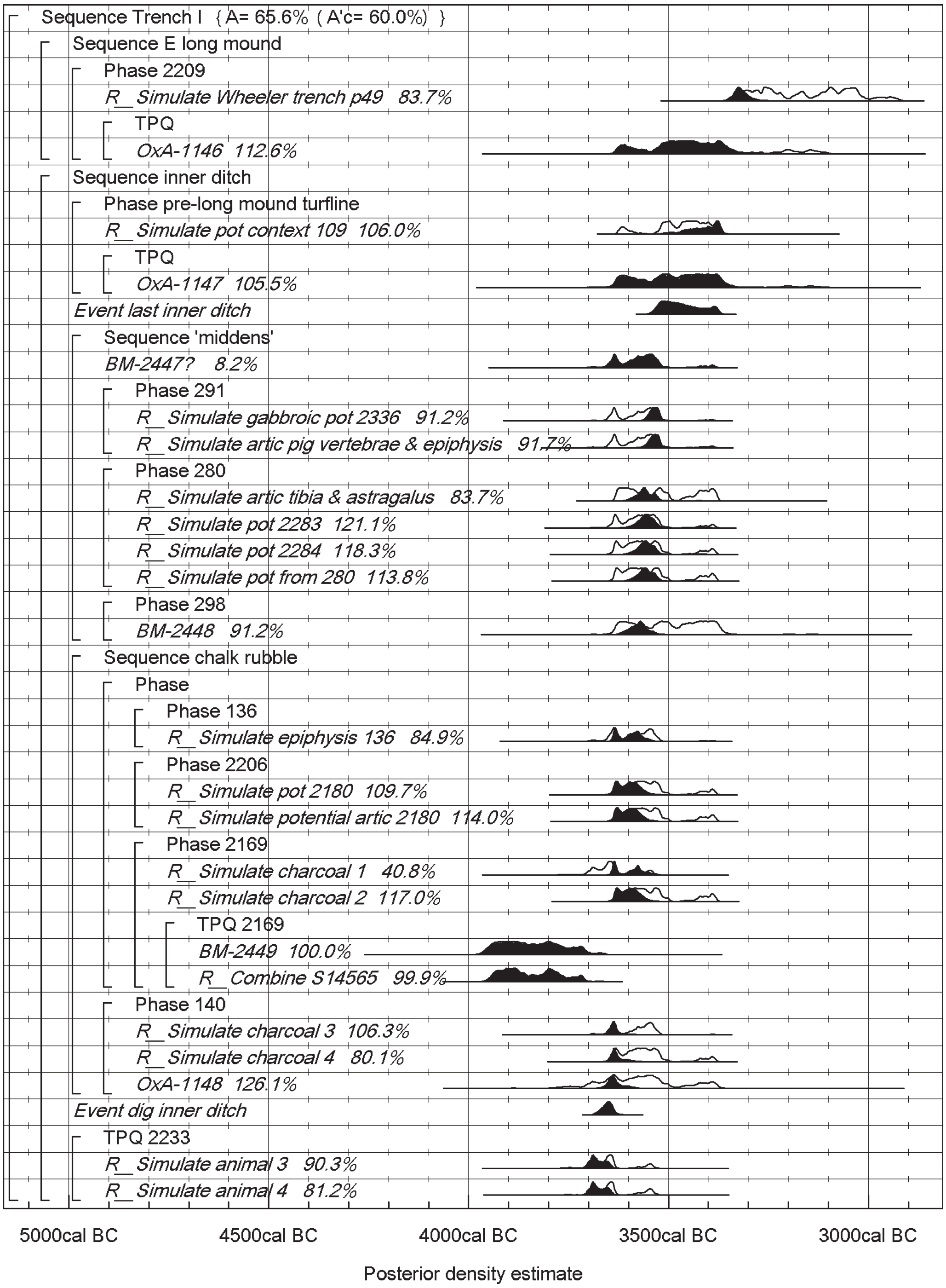


Fig. 4.40. Maiden Castle. Probability distributions of simulated dates and of dates obtained before 1991 from the Trench I sequence, part of one of the simulation models for the whole site. The format is identical to that of Fig. 4.5. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

or perhaps the resolution of this chronology is so fine that the potential age offset in the rings of oak sapwood (10–55 years at 95% confidence for prehistoric English oaks (Hillam *et al*. 1987)) is large enough to count. The remaining sample from these layers (*GrA-29143*) consisted of internal carbonised residue from one of a number of sherds from the same pot, which were found together. It is, however, older than the possibly articulating sample from the same context (*OxA-14835*), as well as the short-life charcoal samples and the articulated skeleton. The sherd may thus be redeposited or the measurement may be biased (see below), and this sample is therefore treated as a *terminus post quem*.

Despite the richness of the overlying 'midden' layers, only four articulating or fitting animal bone samples could be found from them (*GrA-29107*, *-29109* and *OxA-14833* from Trench I, and *GrA-29111* from Trench II). The first three, although stratified one above the other, are statistically indistinguishable (T'=3.5; T'(5%)=6; ν=2), suggesting a rapid accumulation. The pre-existing dates

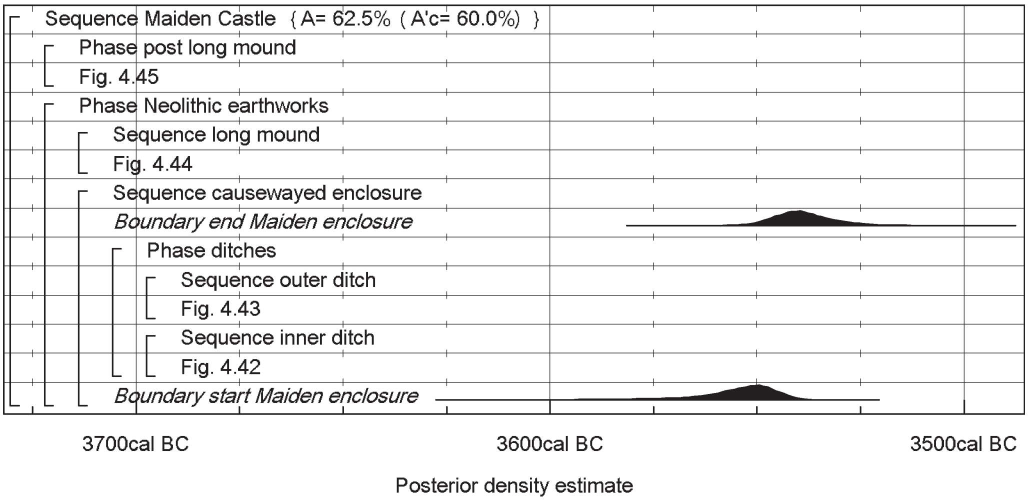


Fig. 4.41. Maiden Castle. Overall structure of the main chronological model for the causewayed enclosure and long mound. The component sections of this model are shown in detail in Figs 4.42–5. The format is identical to that of Fig. 4.4. The large square brackets down the left-hand side of Figs 4.41–5, along with the OxCal keywords, define the overall model exactly.

on disarticulated animal bone from these layers in the same trench (*BM-2447*, *-2448*) and from Trench II (*BM-2454, OxA-1143*) are all treated as *termini post quos* for the subsequent layers.

The remaining samples from the 'middens' were all carbonised internal residues from pottery. *OxA-X-2135-46* (Fig. 4.42) from Trench I was an attempt to obtain a direct date for a gabbroic pot (Cleal 1991, fig. 141: 4).[6] Two measurements (GrA-29209, OxA-14733) were obtained on two sherds from the same pot in context 284 (Fig. 4.42: *284*). These measurements are statistically consistent (T'=1.6; T'(5%)=3.8; ν=1). Further measurements from this context were made on a single sherd (Fig. 4.42: *GrA-29210*) and on one of five conjoining sherds (Fig. 4.42: *GrA-29211*). The measurements on the three residue samples from this context are statistically consistent (T'=3.0; T'(5%)=6.0; ν=2) but are older than an articulated sample from the same layer (Fig. 4.42: *GrA-29107*). They are therefore treated as *termini post quos* for the layers above. Despite the recovery of several sherds from each of two vessels in these contexts, it appears that these sherds were redeposited, becoming fragmented in the process. Alternatively, there may be a technical problem with the dating of these samples (see below, and Chapter 2.7). In Trench II a pair of statistically consistent replicate measurements on two sherds of the same vessel are of similar age (Fig. 4.42: *553*; OxA-14734, GrA-29207; T'=3.6; T'(5%)=3.8; ν=1). This is also treated as a *terminus post quem* for the layers above. In the upper levels of Trench I, a further residue measurement (Fig. 4.42: *OxA-14792*) is again of similar age and older than a disarticulated bone sample from the same layer (Fig. 4.42: *OxA-1147*). Both are treated as *termini post quos* for the layers above. In Trench II, a further sample, a disarticulated animal bone, was dated from these upper layers (Fig. 4.42: *OxA-1142*), and is treated as a *terminus post quem* for the end of Neolithic use of the enclosure. Higher in the fill of Trench II, in context 529/530, a disarticulated animal bone (Fig. 4.45: *OxA-1141*) is treated as a *terminus post quem* for the layers above it.

In both cuttings in this ditch, residues from sherds were consistently older than articulating or fitting animal bone and short-lived charcoal from the same or equivalent contexts. This may suggest that in this ditch the results from carbonised residues are biased towards older ages, although it should be noted that consistent measurements on the same residues have been obtained independently by two different laboratories. Alternatively, it is conceivable that much of the pottery in the ditch was derived from a single source, such as a midden which was generated during a particular event and only progressively incorporated into the fills. This is not impossible, since all the results on the residues are statistically consistent (T'=8.9; T'(5%)=12.6; ν=6). On the other hand, the results from the bone in these layers (articulating, fitting, and disarticulated) are also statistically consistent (T'=19.4; T'(5%)=19.7; ν=11), and significantly different from those on the residues (T'=56.0; T'(5%)=28.9; ν=18.0). As it is highly unlikely that the postulated midden contained pottery and no bone, it seems more probable that there is a technical difficulty with the dating of these sherds (see Chapter 2.7 for further discussion).

The model shown in Figs 4.41–5 places the date when the inner ditch was dug between the deposition of the bones in pre-ditch feature 2233 (context 299) and that of the earliest articulated sample from within the ditch. On this basis, we estimate that the inner ditch was constructed in *3575–3535 cal BC* (*95% probability*; Fig. 4.42: *dig Maiden inner*), probably in *3560–3540 cal BC* (*68% probability*).

The outer ditch (Fig. 4.43). No articulating or fitting animal bone samples could be found. Further samples were dated from among the substantial, well preserved, disarticulated bone fragments in the basal layer in both Trenches II and V. In Trench II, two human femora (Fig. 4.43: *BM-2451*, *OxA-1338*) and a cattle tibia (*BM-2452*) were augmented by

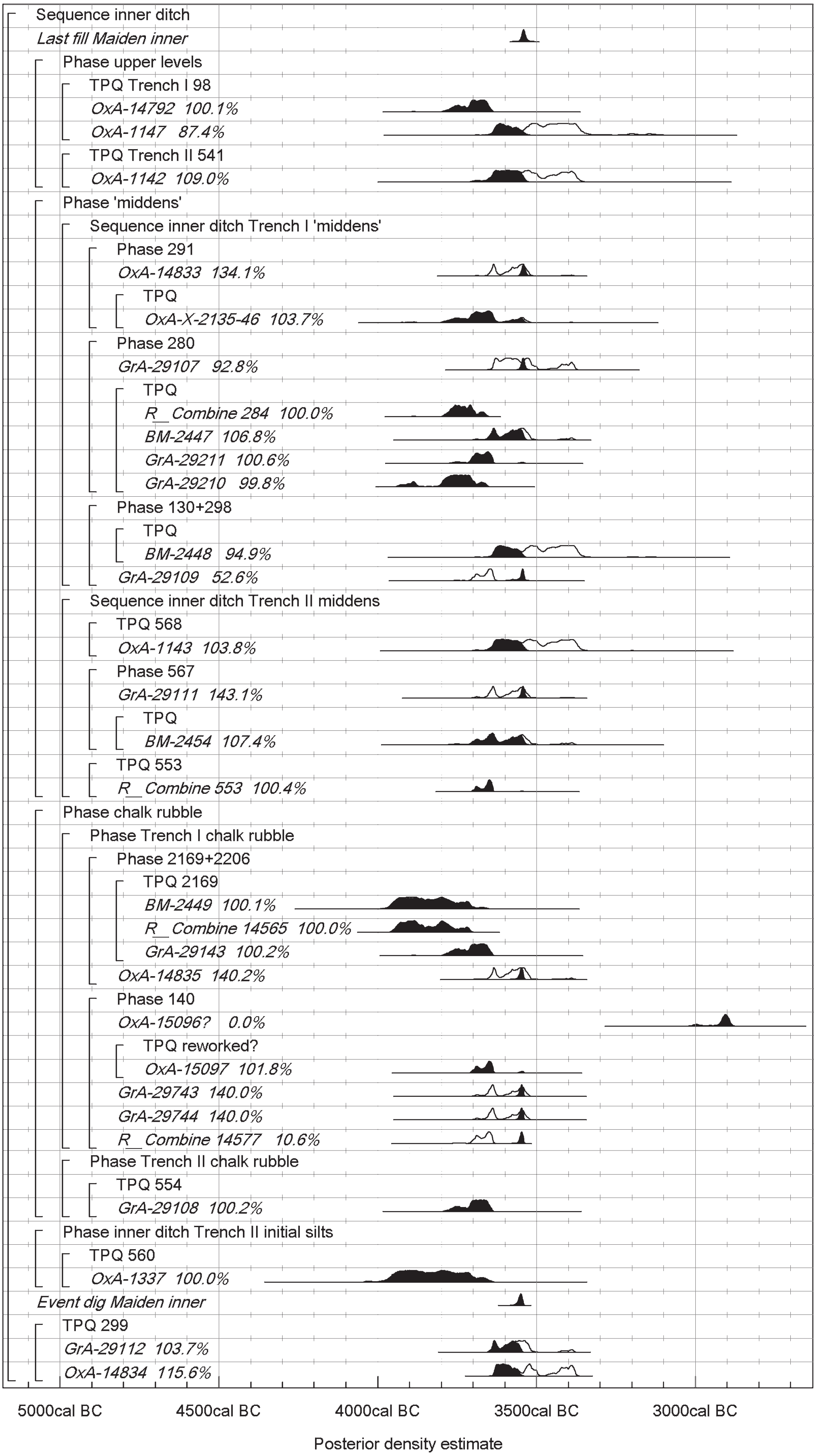


Fig. 4.42. Maiden Castle. Probability distribution of dates from the inner ditch of the causewayed enclosure. The format is identical to that of Fig. 4.5. The overall structure of this model is shown in Fig. 4.41, and its other components in Figs 4.43–5.

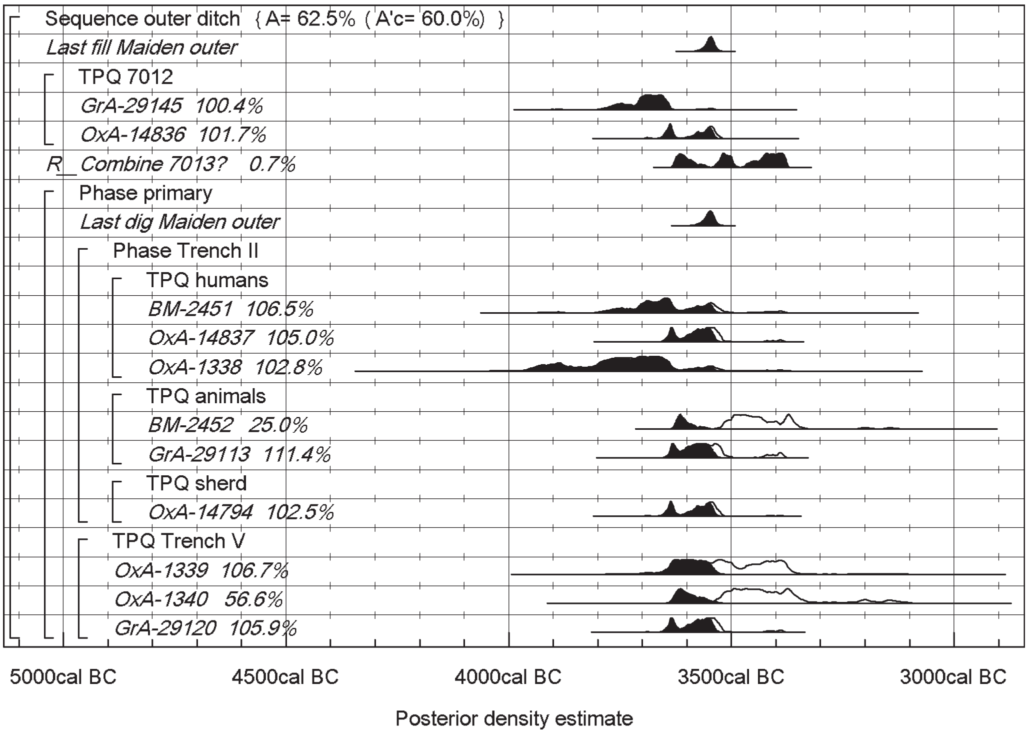


Fig. 4.43. Maiden Castle. Probability distributions of dates from the outer ditch of the causewayed enclosure. The format is identical to that of Fig. 4.5. The overall structure of this model is shown in Fig. 4.41, and its other components in Figs 4.42 and 4.44–5.

a juvenile human mandible (*OxA-14837*), a sheep horncore (*GrA-29113*) and residue from a sherd (*OxA-14794*). The six measurements are statistically consistent (T'=10.4; T'(5%)=11.1; ν=5). The human bones are not significantly earlier than the animal bones, *contra* Sharples and Clark (1991) and Cleal (2004), and thus no question of curation need arise.

From Trench V, in addition to existing dates on a large ungulate rib (Fig. 4.43: *OxA-1339*) and a cattle mandible (Fig. 4.43: *OxA-1340*), a further measurement was obtained for a cattle mandible from a different animal (Fig. 4.43: *GrA-29120*). These three results are also statistically consistent (T'=3.3; T'(5%)=6.0; ν=2).

The bones found in these primary contexts are rather substantial and are not associated with any obvious organic soil. The absence of any articulation suggests that these are deliberately collected groups of bones which were carefully placed for reasons unknown on the base of the ditch. The ditch had only recently been dug because there is no obvious erosion deposit beneath the bones, and these were placed immediately prior to the ditch being infilled because the ditch sides in Trench V show little evidence for erosion (Fig. 4.30: section C).

In Trench V disarticulated and residue samples were also dated from the overlying layers, on the grounds that the infilling appeared so rapid (Wheeler 1943, pl. LXXIII; Sharples 1991a, 52, fig. 53) that, if well preserved, they should not be far in age from the construction. In 7013, immediately overlying the basal layer, two measurements on residue from fragments of a single large sherd (GrA-29213, OxA-14793) are not statistically consistent (T'= 17.2; T'(5%)=3.8; ν=1; Table 4.9). Both results have been excluded from the model. Of the two disarticulated bone samples from 7012 (Fig. 4.43), the layer above, one (*OxA-14836*) was comparable to the animal bone dates from the initial silts and the other (*GrA-29145*) was older. Both are treated as *termini post quos* for the backfilling of the ditch.

Since all the samples from the basal fills were disarticulated, our estimate of the construction date is provided by the most recent of them. On this basis, we estimate that the outer circuit was built in *3580–3525 cal BC* (*95% probability*; Fig. 4.43: *dig Maiden outer*), probably in *3560–3535 cal BC* (*68% probability*).

The long mound (Fig. 4.44). A search for appropriate samples from the initial silts of the long mound ditches yielded only one, an antler implement from east of the causeway in Trench III (*GrA-29146*). A pit cut into this layer had already provided an antler fragment (Fig. 4.44: *OxA-1349*). To the west of the causeway in the same trench, the basal layer (991) of pit 2276, also cut into the initial silt, yielded two further antler implements (Fig. 4.44: *OxA-14838*, *GrA-29147*) in addition to one already dated by *OxA-1145*. From the immediately overlying layers two existing disarticulated animal bone samples (Fig. 4.44: *OxA-1576*, *BM-2456*) were augmented by residue from a sherd (OxA-14881). The latter dated to 410–260 cal BC and probably derived either from Iron Age ditch 806, which cut into layer 828, to which the sherd was attributed (Sharples 1991a, fig. 57), or from Iron Age pit 2272. It is

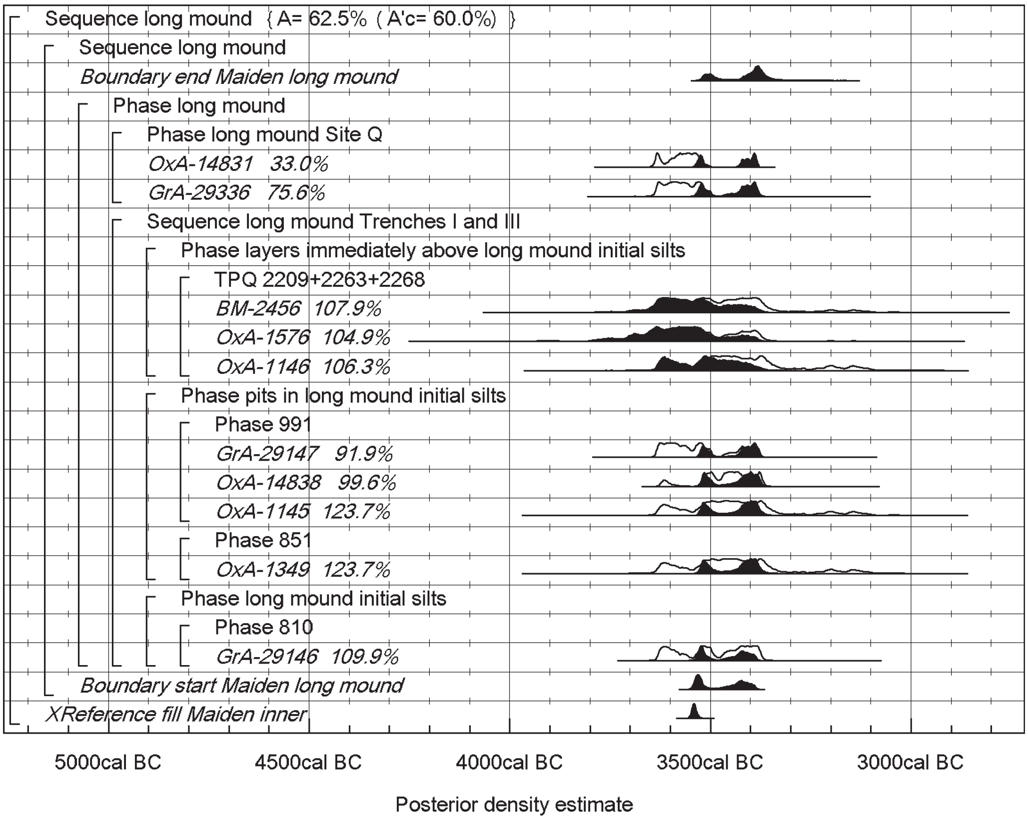


Fig. 4.44. Maiden Castle. Probability distributions of dates from the long mound. The format is identical to that of Fig. 4.5. The overall structure of this model is shown in Fig. 4.41, and its other components in Figs 4.42–3 and 4.45.

excluded from the model. An equivalent layer in Trench I had already provided a further disarticulated sample (*OxA-1146*). All three disarticulated samples are treated as *termini post quos* for the layers above.

Wheeler's excavation of the terminal of the south ditch 200 m to the east provided two further antler implements from a layer immediately overlying the initial silts (Fig. 4.44: *GrA-29336*, *OxA-14831*), from the same context as the undated aurochs skulls noted above. All seven antler samples are statistically indistinguishable, regardless of stratigraphic or horizontal location (T'=6.9; T'(5%)=12.6; ν=6). Their consistency suggests that we are justified in combining samples from the central and eastern parts of the long mound into a single model, as these two elements were probably contemporary, as discussed above. Two other samples from subsequent fills in the long mound ditches in Trench III were also dated and are used as *termini post quos* for succeeding layers (Fig. 4.45).

On the basis of the model shown in Figs 4.41–5, we estimate that the central and east parts of the long mound were built in *3545–3500 cal BC* (*40% probability*; Fig. 4.44: *start Maiden long mound*) or *3480–3385 cal BC* (*55% probability*), probably in *3545–3515 cal BC* (*33% probability*) or *3440–3395 cal BC* (*35% probability*).

The bank between the ditches (Fig. 4.45). An attempt was made to date internal carbonised residue from a Mortlake Ware rim sherd (Cleal 1991, fig. 146:2) from the finds-rich surface beneath the bank. The sample failed. *OxA-1336*, measured on a disarticulated animal bone from the body of the bank, provides a *terminus post quem* of *3625–3600 cal BC* (*1% probability*; Fig. 4.45) or *3525–3020 cal BC (94% probability*), probably *3495–3460 cal BC* (*7% probability*) or *3380–3260 cal BC* (*26% probability*) or *3240–3100 cal BC* (*35% probability*).

An interpretive chronology

The causewayed enclosure at Maiden Castle began to be built in *3580–3535 cal BC* (*95% probability*; Fig. 4.41: *start Maiden enclosure*), probably in *3560–3540 cal BC* (*68% probability*): the 3550s or 3540s cal BC. The inner circuit was constructed in *3575–3535 cal BC* (*95% probability*; Fig. 4.42: *dig Maiden inner*), probably in *3560–3540 cal BC* (*68% probability*). The outer circuit was built in *3580–3525 cal BC* (*95% probability*; Fig. 4.43: *dig Maiden outer*), probably in *3560–3535 cal BC* (*68% probability*).

The constructions of the two circuits at Maiden Castle (Fig. 4.46; Table 4.10) are so close in date that it is not possible to determine which was dug first (it is *57% probable* that the inner is earlier than the outer, for example). By calculating the difference between the two posterior density estimates for the construction of each circuit, it is possible to estimate, however, how far apart they are in date (Fig. 4.47: *period construction*). It is perfectly possible that the two circuits were precisely contemporary, that is, were dug in the same year. It is very probable that they were

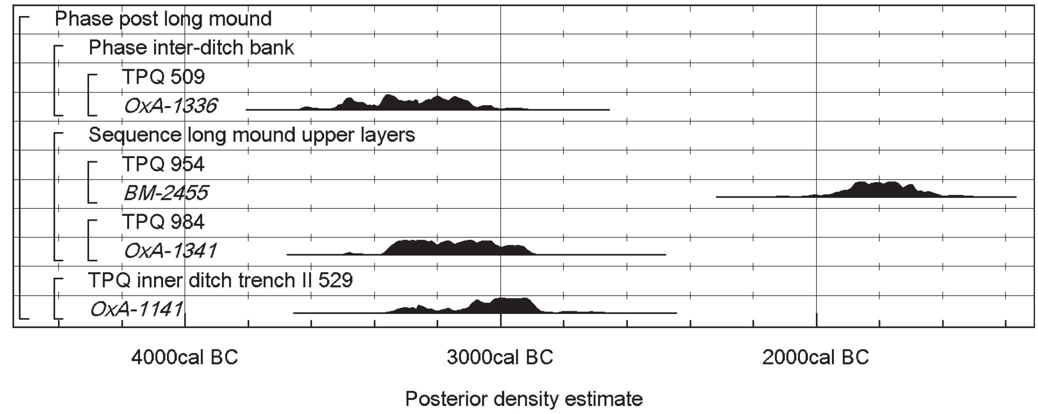


Fig. 4.45. Maiden Castle. Probability distributions of Neolithic dates from contexts later than the long mound. The format is identical to that of Fig. 4.5. The overall structure of this model is shown in Fig. 4.41, and its other components in Figs 4.42–4.

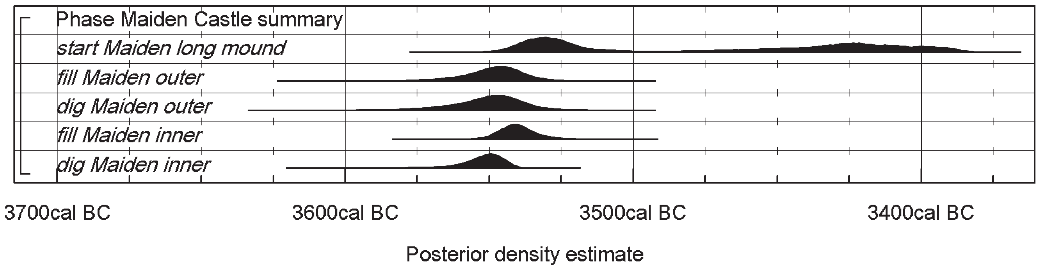


Fig. 4.46. Maiden Castle. Probability distributions of key parameters, derived from the model defined in Figs 4.41–5. The format is identical to that of Fig. 4.5.

constructed within 20 years of each other (*−15–20 years at 68% probability*) and almost certain that they were constructed within 40 years of each other (*−30–40 years at 95% probability*).[7] This means that, for example, it is *68% probable* that the outer ditch could be up to 15 years earlier than the inner ditch, or that the inner ditch could be up to 20 years earlier than the outer. Whatever the order of the construction of the circuits, the enclosure was in place within a single generation.

On the basis of the material dated from their fills, the enclosure ditches filled up quickly. The inner ditch was full by *3555–3525 cal BC* (*95% probability*; Fig. 4.42: *fill Maiden inner*), probably by *3550–3530 cal BC* (*68% probability*). The outer ditch was full by *3575–3525 cal BC* (*95% probability*; Fig. 4.43: *fill Maiden outer*), probably by *3560–3535 cal BC* (*68% probability*). Overall, both ditches were filled by *3555–3520 cal BC* (*95% probability*; Fig. 4.41: *end Maiden enclosure*), probably by *3550–3530 cal BC* (*68% probability*).

The use of the Maiden Castle causewayed enclosure was remarkably short. Overall, the period between the cutting of the first ditch and the final filling of the last ditch lasted *1–50 years* (*95% probability*; Fig. 4.47: *use Maiden Castle*), probably *1–20 years* (*68% probability*) or the span of a single generation. The inner ditch probably took a few years to fill up: *1–35 years* (*95% probability*; Fig. 4.47: *use Maiden inner*) or *1–20 years* (*68% probability*). In contrast, it appears that the outer ditch filled up even more quickly, perhaps more quickly than can be reliably estimated by radiocarbon dating. The model estimates that the outer ditch was infilled in *0–20 years* (*95% probability*; Fig. 4.47: *use Maiden outer*) or in *less than a year* (*68% probability*)!

The eastern and central parts of the long mound were constructed in *3550–3500 cal BC* (*40% probability*; Fig. 4.44: *start Maiden long mound*) or *3480–3385 cal BC* (*55% probability*), probably in *3545–3515 cal BC* (*33% probability*) or *3440–3395 cal BC* (*35% probability*). It is *99.6% probable* that the outer ditch of the causewayed enclosure had been dug and had filled up by the time the long mound was constructed. It is more difficult to estimate the duration of the gap between the disuse of the enclosure and the initiation of the long mound, evidenced in the formation of a slight soil above the inner causewayed enclosure ditch in Trench I. This can be estimated, however, to have lasted *1–40 years* (*40% probability*; Fig. 4.47: *gap Maiden enclosure/long mound*) or *60–160 years* (*55% probability*), probably *0–25 years* (*35% probability*) or *95–140 years* (*33% probability*).

Sensitivity analyses

Reconciling the radiocarbon measurements from Maiden Castle with the archaeological information has been a challenge! Every variant model in which the long mound was considered to be part of the same, continuous phase

Table 4.10. *Successive estimates of construction dates for the two circuits and long mound at Maiden Castle, Dorset.*

Estimate	**Construction of inner circuit**	**Construction of outer circuit**	**Construction of long mound**
Sharples and Clark (1991)	3900–3700 cal BC	3900–3700 cal BC	Before *c.* 3350 cal BC
Barclay and Bayliss (1999)			*3520–3200 cal BC (95% probability; const_Maiden_Castle*; Barclay and Bayliss 1999, fig. 2.4)
Cleal (2004)	Slightly before 3760–3370 cal BC (OxA-1148, the articulated child burial in the rubble fills)	After 3630–3340 cal BC (BM-2452, the youngest of the animal bone samples from the primary silt)	
Modelling of dates available in 2003	*3770–3370 cal BC (95% probability*; Fig. 4.35: *build inner*)	*3520–3355 cal BC (95% probability*; Fig. 4.36: *dig outer*)	*3535–3365 (95% probability*; Fig. 4.35: *build E and central long mound*)
This project	*3575–3535 cal BC (95% probability*; Fig. 4.42: *dig Maiden inner*)	*3580–3525 cal BC (95% probability*; Fig. 4.43: *dig Maiden outer*)	*3550–3500 cal BC (40% probability*; Fig. 4.44: *start Maiden long mound*) or *3480–3385 cal BC (55% probability)*.

of Neolithic activity as the causewayed enclosure had poor overall agreement ($A_{overall} \geq 1.7\% \leq 51.8\%$). This means that there was almost certainly a gap between the use of the enclosure and the construction of the dated portion of the long mound (as suggested by the independent archaeological information of slight soil formation in the top fills of the inner ditch before construction of the long mound (Sharples 1991a, 51)).

Only this choice in the modelling process has produced models in which the resultant date estimates vary substantively. For this reason, an alternative model is not presented for the chronology of this site.

Implications for the site

The Maiden Castle causewayed enclosure was short-lived, in use for 50 years at most. Both the freshness of the ditch sides in Trench V and the interpretation of the radiocarbon dates from its fills combine to suggest that the outer ditch – at least on the eastern side of the enclosure – was dug and filled with dramatic rapidity, possibly within as little as a year. The inner ditch probably took at most 35 years to infill, and the succession of 'midden' layers would fit this longer estimate. Even this is strikingly shorter than most commentators have allowed for sites of this kind. A short timescale would be consistent with the condition of the animal bone, which came principally from these layers, and was relatively little weathered and little gnawed (Armour-Chelu 1991). It seems unlikely that this material had accumulated for substantial periods of time in middens or other deposits. Things were over at the Maiden Castle causewayed enclosure with a rapidity that has rarely been contemplated or discussed. The answer to 'over how long a period did the 'midden' and loam layers in the inner enclosure ditch accumulate?' is less than 35 years.

The two certain Neolithic circuits at Maiden Castle encompass a large area of some 8 ha. It is hard, with so much of the circuit concealed by Iron Age earthworks, to come to specific labour estimates for this particular task, but in general terms at least this was a large undertaking that we can now say was carried out quickly. If the two circuits were built together, the workforce could approximate to twice Mercer's estimate of 100 people over four months for the single circuit of the comparably-sized main enclosure at Hambledon (see above).

The statistical indistinguishability of all seven antler samples from the initial silts of the long mound ditches and the deposits immediately succeeding them suggests that the two elements were built, or at least silted up, together, after the enclosure ditches were full. At least two of the samples (Fig. 4.44: *GrA-29146, OxA-1349*), and possibly five (Fig. 4.44: *GrA-29146–7, OxA-1349, OxA-1145, OxA-14838*) came from the ditch of Bradley's putative preceding long barrow. The case for this earlier monument remains to be made.

Samples could not, unfortunately, be located with which to refine the date of the bank between the inner and outer circuits, or to clarify the overall extent of third or second millennium modification of the earthworks.

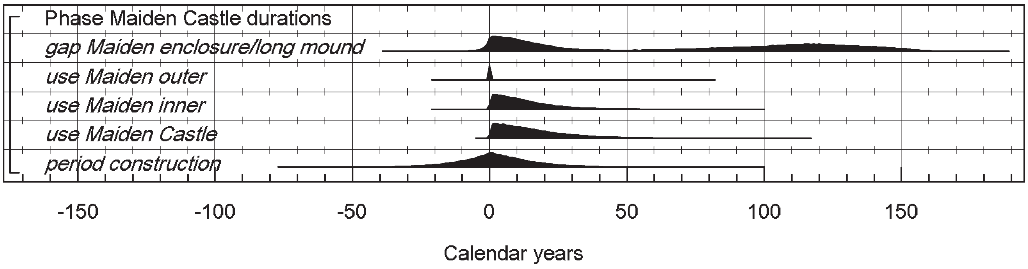


Fig. 4.47. Maiden Castle. Probability distributions of the number of years during which various activities occurred, derived from the model defined in Figs 4.41–5. The format is identical to that of Fig. 4.5.

The short sequence proposed here raises the question of how the new timescale affects interpretation of the molluscan and other environmental evidence (Evans and Rouse 1991; J. Evans 1991; R. Gale 1991a), which was originally predicated on greater time depth. The early part of that sequence may be summarised as follows: by the time the possibly pre-enclosure feature in Trench I was cut, primary woodland (site mollusc zone A) evidenced in treeholes low in the pre-bank soil had given way to woodland with a slight open country element (site mollusc zone B). A transition to rather more open conditions (site mollusc zone C) took place *within* the 'middens' sequence in the upper part of the inner ditch, and these conditions persisted through the soil which formed over the inner ditch and the overlying lowest fills of the long mound ditch. The increase in open country taxa, however, was not such as to indicate widespread clearance and cultivation (Evans and Rouse 1991, 124, figs 107–111). Could it be that, on the much shorter timescale now suggested, the Mollusca reflect a locally significant, short-term impact on the vegetation? What if the transition to less wooded conditions was the result of the construction of the outer circuit and the disruption of the surrounding vegetation that would have gone with it (perhaps including for defensive considerations)? Single layers of chalk rubble dividing the 'middens' sequences in the inner ditch in both Trenches I and II could mark this ground disturbance (Sharples 1991a, 51, fig. 51: 236, fig. 59: 550). The argument is more convincing for context 236 in Trench I, which could have derived from the exterior, than for context 550 in Trench II, which derived from the interior (Amanda Rouse, pers. comm.).

Woodland (site mollusc zone D) regenerated soon after the long mound ditches had begun to silt, the transition falling within context 202 in Trench I (Fig. 4.30: section B) and between contexts 2268 and 984 in Trench III (Sharples 1991a, figs 49, 57). There was some disturbance to the woodland cover, but no indication of open country, in succeeding site mollusc zone E, the transition to which fell at the interface of contexts 98 and 179 in Trench I and 984 and 954 in Trench III (Sharples 1991a, figs 49, 57). Users of Peterborough Ware frequented the site at this time, while it was wooded. This episode may have begun with the final accumulation of the layers immediately above the initial silts of the long mound in *3530–3455 cal BC* (*26% probability*; Fig. 4.44: *end Maiden long mound*) or *3435–3300 cal BC* (*69% probability*), probably in *3520–3495 cal BC* (*14% probability*) or *3410–3360 cal BC* (*54% probability*). It ended with the start of accumulation of context 954, a layer for which there is a *terminus post quem* of *1965–1610 cal BC* (*95% probability*; Fig. 4.45: *BM-2455*), probably of *1885–1730 cal BC* (*60% probability*) or *1720–1690 cal BC* (*8% probability*). If the site remained wooded for more than a thousand years, the scale and intensity of its use in the later fourth and the third millennium could have been slight. There is more than 30 times as much Neolithic Bowl pottery from the site as there is Peterborough Ware, and Grooved Ware is even scarcer (18096 g, 568 g and 90 g respectively; Cleal 1991, 171–82). Correspondingly, lithics from those fills of the long mound corresponding to the upper part of site mollusc zone C and to all of site mollusc zone D (phases 3A, 3B, 3E and 3F) are scant compared with the quantities from the enclosure (Edmonds and Bellamy 1991, tables 76–8) and even their low numbers must be inflated by earlier material, especially in Trench I (Edmonds and Bellamy 1991, 220). It is arguable that the site was little frequented from soon after the construction of the long mound to the start of cultivation on the hill.

In this case, the local concentration of flint axehead manufacture on the hill, noted above, calls for further examination, since the lack of evidence for axe manufacture elsewhere in the area suggests that Maiden Castle remained a focus for this activity throughout the Neolithic, rather than during the relatively short combined use-lives of the enclosure and the long mound. It is conceivable that this was one of the activities for which people continued to frequent Maiden Castle. Thinning, mass reduction and retouch flakes occurred in the ditches of the long mound on site III, away from the enclosure (phases 3E, 3F), suggesting a continuation of the practice at least after the construction of the long mound. Selective retention of lithics from the Wheeler excavations makes it impossible to judge the full distribution of such pieces. It may be significant that the total of over 50 flaked flint axeheads, picks and irregular core tools from both excavations was more widely distributed than ground flint axeheads, occurring throughout the excavated areas in pits, the enclosure and long mound ditches, and post-Neolithic contexts (Wheeler 1943, 168–71; Edmonds and Bellamy 1991, tables 78–9). Some of these could have dated from the period of low

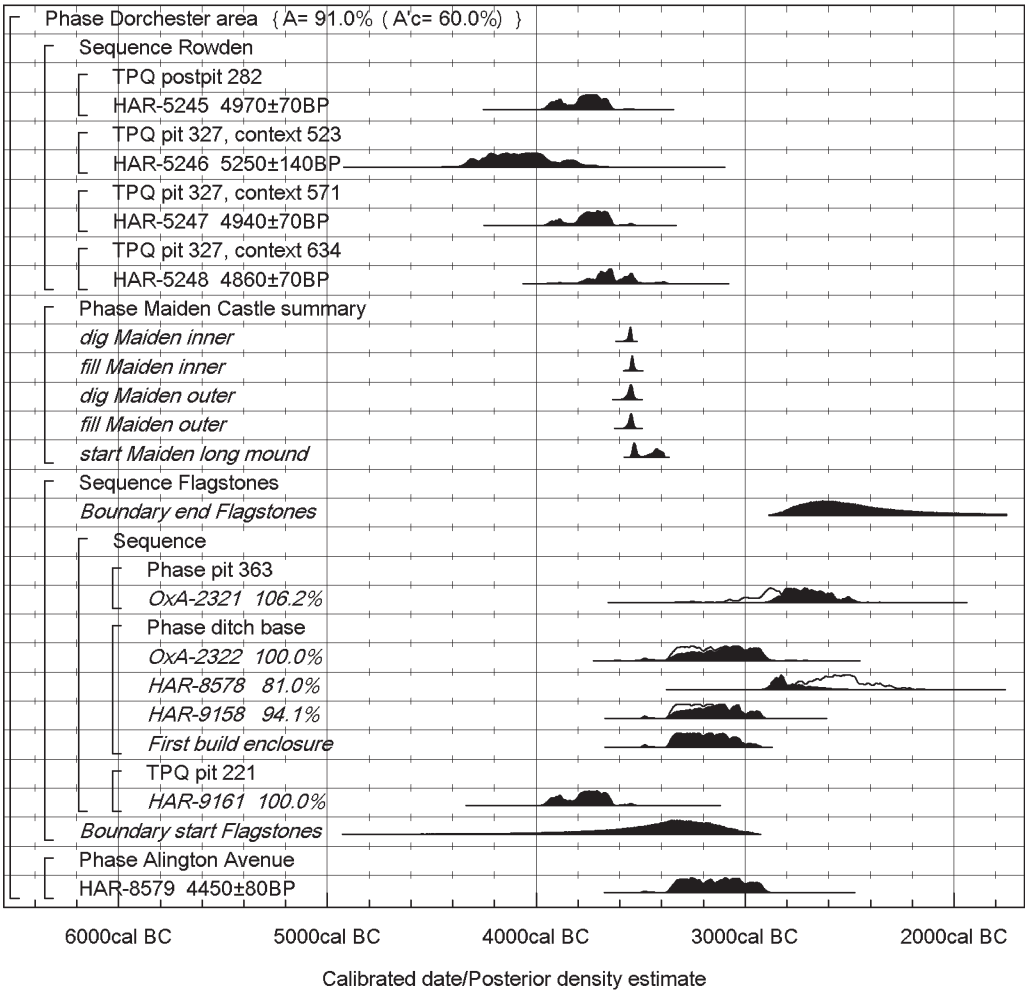


Fig. 4.48. Dorchester area. Probability distributions of fifth and fourth millennium cal BC radiocarbon dates. The format is the same as for Fig. 4.5. The model is defined exactly by the OxCal keywords, and the brackets down the left-hand side of the diagram.

frequentation although, without the relevant debitage, it is impossible to tell if they were made on the hill.

Activity intensified only when open conditions were established in site mollusc zone F, which corresponds to Beaker and Early Bronze Age cultivation horizons extending up to the silted enclosure and long mound ditches. It is from these levels (phases 3C, 3D and 3G) onwards that an admixture of late Neolithic and Early Bronze Age elements becomes evident in the lithics (Edmonds and Bellamy 1991, 218). Beaker pottery is correspondingly less infrequent than Peterborough Ware or Grooved Ware (Cleal 1991, 183).

Implications for the local setting

In earlier discussion, Niall Sharples and colleagues have suggested that the enclosure could be seen as the locus for dangerous ritual, to be negotiated away from areas of normal occupation (J. Evans *et al*. 1988; Sharples 1991a, 255). Roger Mercer (2006a; 2006b) has suggested a context of warfare and conflict. If either line of interpretation is followed, we can now add a strikingly short timescale. Ritual or actual dangers in this case might have been both pressing and then resolved swiftly; they do not seem to have recurred. In more general terms of social interaction, only one or two other authors have argued for the event-like character of enclosure construction (Whittle 1988) or short durations of use, unsustainable for longer because of the potential for conflict, competition and fission (Thorpe 2001). In the case of Maiden Castle, distance from settlement (and livestock) was inferred from the more or less wooded environment of the enclosure. This contrasts with the open long grassland which was established in the lower-lying Dorchester area 2–3 km to the north by the time a pit which may date to the earlier fourth millennium (Table 4.9: HAR-9131) was cut on what was to become the site of the Flagstones enclosure (M. Allen 1997a, 167, tables 36, 78; 1997c). The extent of clearance here was appreciably greater than in mollusc zone C at Maiden Castle, with open country taxa exceeding 50% of the total (M. Allen 1997a, fig. 82), a value not reached until much later, in the top of the ditches of the enclosure and especially of the long mound (Evans and Rouse 1991, figs 107–9).

The causewayed enclosure at Maiden Castle emerges

as a monument built and used rapidly in the 36th century cal BC. Both its date and short duration demand further discussion. Could Maiden Castle have been the first enclosure in this vicinity? It may not have been, since aerial photographic coverage of this area is far from complete (Martyn Barber, pers. comm.). In the present state of chronology for the local area, it is not easy to say whether the enclosure at Maiden Castle was the first significant construction of any kind in the fourth millennium cal BC. The wealth of Neolithic monuments and settlements which surrounds Maiden Castle is poorly dated. This applies with particular force to the numerous long barrows (Ashbee 1970, fig. 3; Sharples 1991a, fig. 14; P. Woodward 1991, fig. 68), none of which has been excavated in recent times. Their relationship to Maiden Castle remains unknown.

The available radiocarbon dates for the region are listed in Table 4.11 and modelled in Fig. 4.48. Activity which might precede the construction of the Maiden Castle enclosure is evidenced by pits, two at Rowden, 5 km to the west (*HAR-5245–8*), and one of two pre-dating the Flagstones enclosure 3.5 km to the north (*HAR-9161*). All five measurements are on bulk charcoal samples which may have included already old material, and can be taken only as *termini post quos* for their contexts. The Rowden samples (HAR-5245–8) were processed as described by Mook and Streurman (1983). HAR-5246 was dated as described by Otlet *et al.* (1983), and the remaining four as described by Otlet and Polach (1990). Pit 327 here must date from the time of, or after, the date from the basal layer (95% confidence; 3790–3510 cal BC; Table 4.11: HAR-5248), the older samples from overlying layers clearly predating the contexts from which they were recovered. The Flagtones and Rowden pits *may* be earlier than the Maiden Castle enclosure, but this remains to be determined.

The seven pots represented in pit 327 at Rowden may reinforce the case for an early date. They are characterised by a predominance of light-rimmed, Carinated Bowl forms with open to neutral profiles and no lugs. They were recognised from the first as distinct from the Maiden Castle assemblage (Davies *et al*. 1991, 97–8), which is dominated by neutral, uncarinated forms with some heavy rims and quite frequent lugs, and shows the classic features of the South-Western style (Cleal 1991). They also differ in fabric; the Rowden vessels are tempered mainly with combinations of fossil shell and quartz sand, a couple containing sand alone (Davies *et al*. 1991, 97–8), with none of the flint-tempered or gabbroic wares found at Maiden Castle (Cleal 1991, table 54). South-Western features are also prominent in smaller Bowl assemblages from the Dorchester area, such as those from Sutton Poyntz 5 km east of Maiden Castle on the South Dorset Ridgeway (Farrar 1957) and from sites in Dorchester itself, including the surface beneath the bank of Mount Pleasant (Longworth 1979, 84), the Flagstones pits (Cleal 1997, 89–94), or, on the basis of a verbal description alone, from Middle Farm, Dorchester (Morris 2004). Cleal has subsequently argued (2004) that the Rowden assemblage may, like that from Roughridge Hill, Wiltshire (see Chapter 3), be one of several dating from before the development of the regional Bowl styles consistently found at causewayed enclosures.

To the north, in the present area of Dorchester, the Alington Avenue bank barrow and the Flagstones enclosure are the earliest monuments so far known to have been built close to the Frome, in long established grazed grassland (M. Allen 1997a; 1997c; 2002b), followed in the third millennium by, among others, Mount Pleasant, Maumbury Rings and the Dorchester timber circle.

HAR-8579 from Alington Avenue and *HAR-8578*, *-9158* and *-9161* from Flagstones were prepared as described by Ambers and Bowman (1994) and dated as described by Otlet and Polach (1990). *OxA-2321–2* from Flagstones were prepared as described by Law and Hedges (1989) and R. Hedges *et al*. (1989a) and dated as described by Bronk and Hedges (1989).

Alington Avenue yielded only a single radiocarbon determination (3370–2900 cal BC; 95% confidence; Fig. 4.48: HAR-8579) on a cattle skull which could have been already old when placed on the base of the ditch (S. Davies *et al.* 2002, 15, pl. 4, fig. 7), although the recovery from an adjacent context of an atlas and one other cervical vertebra probably from the same animal (Maltby 2002, 53) suggests otherwise. This provides a *terminus post quem* for construction. Of the four relevant dates from Flagstones (Fig. 4.48), three are for samples from the base of the ditch, two of them on antler implements (*HAR-8578*, *OxA-2322*) and the third on an articulated burial (*HAR-9158*); the fourth date (*OxA-2321*) is on a second burial cut into the lower part of the rubble fills. HAR-8578 is not statistically consistent with the other samples from the ditch base (T'=14.8; T'(5%)=6.0; ν=2). The similarity of *HAR-8578* and *OxA-2321* raises the possibility that the implement dated by *HAR-8578* was on the base of an undetected cut. The sequence as recorded suggests that the Flagstones enclosure was built in *3365–2960 cal BC* (*95% probability*; Fig. 4.48: *build enclosure*), probably in *3335–3205 cal BC* (*37% probability*) or *3200–3090 cal BC* (*31% probability*).

This may suggest an interval between the construction of the Maiden Castle long mound in *3550–3500 cal BC* (*40% probability*; Fig. 4.44: *start Maiden long mound*) or *3480–3385 cal BC* (*55% probability*) and that of the Flagstones enclosure and perhaps the Alington Avenue long monument to the north. Uncertainty as to the existence or duration of this interval hinges on the possibility that the Flagstones enclosure was preceded by a stone setting, demolished before or soon after the enclosure there was built. The evidence for this consists of at least three slabs of sarsen and limestone (two of them in primary contexts in the enclosure ditch), and numerous chips and flakes of sarsen, limestone and sandstone, many of them freshly broken and a few altered by fire, which were present from the primary chalk rubble upwards (Copson and Healy 1997). There are also possible stone sockets (Healy 1997a, 30; 1997c, 283).

Table 4.11. Fifth and fourth millennium cal BC radiocarbon dates from the Dorchester area, Dorset. Posterior density estimates derive from the model defined in Fig. 4.48.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Rowden							
HAR-5248	RD82634	Unidentified bulk charcoal sample. Undated remainder *Quercus* sp. (77%), *Corylus* sp. (14%), *Fraxinus* sp. (9%) and unidentified	Pit 327, context 634. Ash- and charcoal-rich basal fill of pit, apparently tipped in from the SW, stratified beneath 571 (Woodward 1991, 43, figs 23–4)	4860±70	−26.5	3790–3510	
HAR-5247	RD82571	Unidentified bulk charcoal sample. Undated remainder *Quercus* sp. sapwood and heartwood (30%), Pomoideae (29%), *Fraxinus* sp. (22%), *Corylus* sp. (19%) and unidentified	Pit 327, context 571. One of successive ash- and charcoal-rich deposits tipped into base of pit, apparently from the SW, stratified above 634 (Woodward 1991, 43, figs 23–4)	4940±70	−26.7	3950–3540	
HAR-5246	RD82523	Unidentified bulk charcoal sample	Pit 327, context 523. Charcoal-rich lens in pit fill, stratified above 571 (Woodward 1991, 43, figs 23–4)	5250±140	−26.3	4320–3950	
HAR-5245	RD82287	Unidentified bulk charcoal sample. Charcoal from this context comprised *Quercus*, *Corylus*, *Fraxinus* and Pomoideae (Woodward 1991, 43; Carruthers and Thomas 1991, table 23)	Postpit 282, context 287. From postpipe in pit which clipped the edge of pit 327. The variety of species identified suggests that this was material which entered the feature after the decay or removal of the post, rather than the charred remains of the post itself (Woodward 1991, 43, fig. 23) The measurement used here is that quoted by Walker *et al.* (1988, 330). It is given as 4970±70 BP in the publication	4690±70	−26.5	3640–3340	
Flagstones							
HAR-9161	18325989	Bulk sample of oak charcoal	Pit 221, context 259. Ash- and charcoal-rich basal fill of pit already present when enclosure built and yielding mollusc assemblage indicative of open long grassland (Healy 1997a, 30, 38, figs 18, 20: J)	4960±80	−26.0	3960–3630	*3950–3635*
HAR-9158	18341731	Human. Skeleton of 2–3 year-old child	Enclosure, segment 19. On ditch base, beneath stone slab (Healy 1997a, 37–8, figs 19: E, 27–8)	4490±70	−23.0	3490–2910	*3350–3000* (*84%*) or *2995–2920* (*11%*)
OxA-2322	581 92	Red deer. Almost complete antler pick retaining brow tine (archive catalogue)	Enclosure, segment 27. On ditch base (Healy 1997a, 38)	4450±90	−24.1	3490–2890	*3340–2905*
HAR-8578	18338244	Red deer. Antler beam fragment at least 280 mm long retaining stump of one tine. A few weathered cut-marks on beam (archive catalogue)	Enclosure, segment 13. On ditch base (Healy 1997a, 38, fig. 19: B)	4030±100	−23.6	2890–2280	*2905–2585*
OxA-2321	364 76	Human. Skeleton of 10–12 year-old child	Enclosure, segment 14, pit 363. Cut into primary chalk rubble fills (Healy 1997a, 38, fig.19: C)	4210±110	−23.0	3090–2480	*2870–2545* (*89%*) or *2540–2485* (*6%*)
Alington Avenue							
HAR-8579	W98SF272	Cattle. Maxilla	From skull found inverted and without mandible on base of ditch of long monument, ?bank barrow (Davies *et al.* 2002, 15, pl. 4, fig. 7). Atlas and one other cervical vertebra from adjacent context probably came from same animal (Maltby 2002, 53), suggesting that it may not have been long dismembered	4450±80	−23.6	3370–2900	

4.4 Robin Hood's Ball, Shrewton and Figheldean, Salisbury, Wiltshire, SU 1011 4604

Location and topography

Robin Hood's Ball lies on one of a series of low, rounded, chalk hills on the Salisbury Plain downland which surrounds the Stonehenge complex (Fig. 4.1). The outlook from the hilltop, roughly halfway between the River Avon to the east and the River Till to the west, is broad in most directions (N. Thomas 1964a, 1). The double-ditched causewayed enclosure, which encloses some 3.5 ha, is sited, however, on the south-facing part of the hill (centred at 135 m OD), and most of the country to the north is not directly visible from the enclosure itself (Fig. 4.1; N. Thomas 1964a, 1). There are no other known causewayed enclosures in the vicinity or for some distance in every direction. There are, however, flint scatters, pottery finds and pits around Stonehenge, and long barrows are found across the Avon-Till interfluve both singly and in small concentrations (Ashbee 1970, fig. 6; J. Richards 1990, fig. 2; Cleal *et al*. 1995, fig. 33; M. Allen 1997b, pl. 2; McOmish *et al*. 2002, fig. 2.3). The nearest, one of a small group of four, lies about 0.5 km to the east of Robin Hood's Ball. Round barrows were subsequently built immediately to the north-east of the enclosure.

The circuits of the enclosure are still visible as earthworks, some 30–40 m apart, both causewayed ditches with almost continuous internal banks (Fig. 4.49; Oswald *et al.* 2001, 43, fig. 1.4). The inner is roughly circular (Oswald *et al.* 2001, fig. 4.6) and its south-east side is slightly flattened, recalling the layout of the inner circuit at Windmill Hill, for example. The outer circuit, which encloses *c.* 3.5 ha, is exceptionally angular in plan, perhaps reflecting disjunctures in construction, and the west side has indications of a possible outwork or horn.

History of investigation

The site was recognised by Colt Hoare (1812, 176), and was surveyed by Flinders Petrie in 1877 (Oswald *et al.* 2001, fig. 2.2). In the late 1920s Alexander Keiller recovered sherds of Neolithic Bowl pottery from a section of the inner ditch cut in making a rifle range (Piggott 1931, 142). Curwen listed the site among Neolithic camps, publishing a sketch plan (1930, 35–7), and the identification of the still unexcavated monument was reaffirmed by Stuart Piggott (1954, 20, 382). In 1956, Nicholas Thomas mobilised the energy and enthusiasm of a class associated with Salisbury Museum to form a 'digging party', which carried out excavation over two August weekends. A cutting was made across the ditch and bank of each circuit and two further cuttings examined a causeway in each (Fig. 4.50; N. Thomas 1964a, fig. 2).

Both ditches had weathered to a breadth at the surface of over 3.75 m, but the inner ditch was strikingly deeper – over 2.5 m from the modern surface – and its sides perhaps originally steeper. Both sections show strikingly asymmetrical fills, with greater amounts of material coming from the inside, where remnants of banks are visible fairly close to the ditch edges (N. Thomas 1964a, fig. 3).

Disconformities in the silting might also suggest some recutting (N. Thomas 1964a, fig. 3). The ditches 'yielded a very great deal of broken pottery and domestic rubbish' (N. Thomas 1964a, 11), including animal bones. Many more finds came from the inner ditch, where they were found in the top of the primary fill and then in the chalky silt layer immediately above, where the deposit 'resembled more closely an actual occupation of the ditch, since it included much charcoal and decayed organic material', suggested through soil analysis to be of short duration (N. Thomas 1964a, 11). Two articulated animal longbones from low in the inner ditch were also taken as a sign of rapid filling (N. Thomas 1964a, 11). No later Neolithic pottery was found in the limited excavations.

There was also occupation both under the outer bank and at its rear. The buried rendsina soil had what reads like an undisturbed turfline (N. Thomas 1964a, 10: 'a stone- and chalk-free zone'), and was covered by sherds, animal bones and a scatter of charcoal. One posthole was recorded. Thomas drew attention to the composition of the outer bank, with chalk at its front and chalk perhaps revetted by turf at its rear, forming 'a Neolithic rampart interleaved with turf and soil' (N. Thomas 1964a, 10). He hints that the posthole and inner turf deposit might be connected, and strongly implies that the bank may have been deliberately levelled (N. Thomas 1964a, 11).

In the early 1980s an area of downland to the north-east of the enclosure was ploughed for the first and only time. This led to the collection of abundant Neolithic artefacts including both Bowl and Peterborough Ware pottery (Cleal 1990c, 235, 244, fig. 154). A salient feature of the lithics was a cluster of scrapers 30 m outside the north side of the enclosure. Two small areas within the scatter were excavated in 1984 and 1986 (J. Richards 1990, fig. 34). One, which coincided with the scraper concentration, contained a roughly circular cluster of pits enclosing an area in which there were over 200 further scrapers together with leaf-shaped arrowheads and other lithics. The pits themselves yielded small quantities of lithics and of South-Western style bowl pottery, including gabbroic ware, and one decorated rim (J. Richards 1990, 61–5).

Previous dating

Prior to this project, there were no radiocarbon measurements from the enclosure. The morphology of the enclosure and artefacts from the ditch cuttings, including South-Western style Bowl pottery, indicated a date in the earlier part of the Neolithic. From two of the pits close to the enclosure, however, samples of cattle bone gave dates of 3710–3340 cal BC and 3510–2910 cal BC (95% confidence; Fig. 4.51; Table 4.12: OxA-1400, -1401; J. Richards 1990).

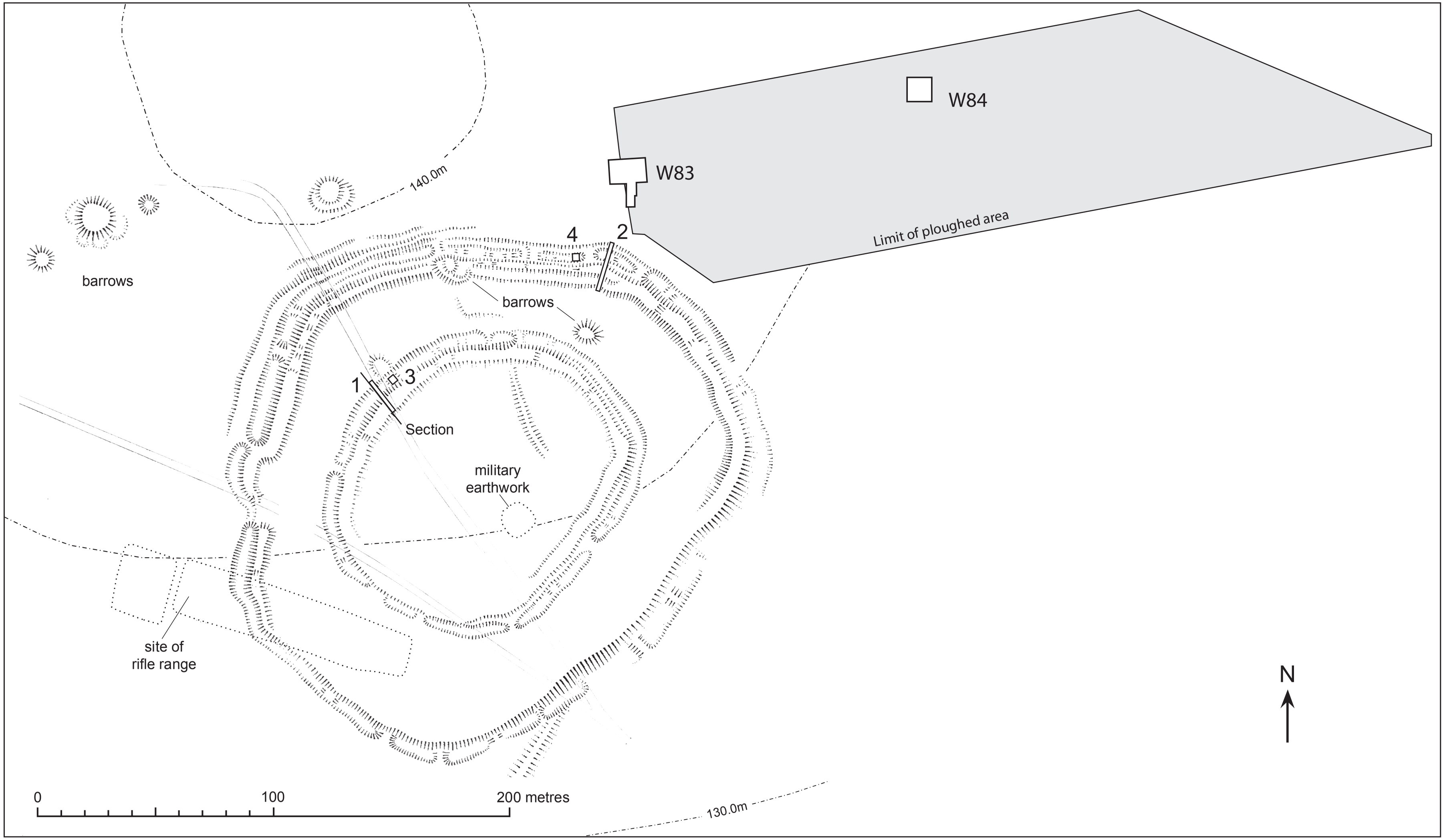


Fig. 4.49. Robin Hood's Ball. Plan showing cuttings and area of surface collection, the latter in grey. After N. Thomas (1964a, fig. 2), J. Richards (1990, fig. 34) and Oswald et al. *(2001, fig. 1.4).*

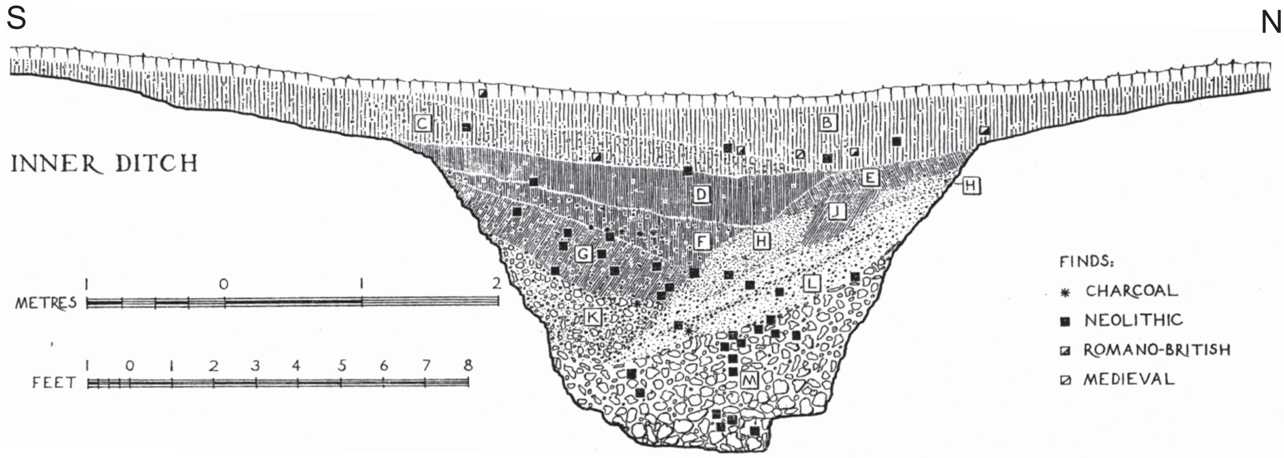


Figure 4.50. Robin Hood's Ball. Section of the inner ditch. The location of the section is shown in Fig. 4.49. After N. Thomas (1964a, fig. 3).

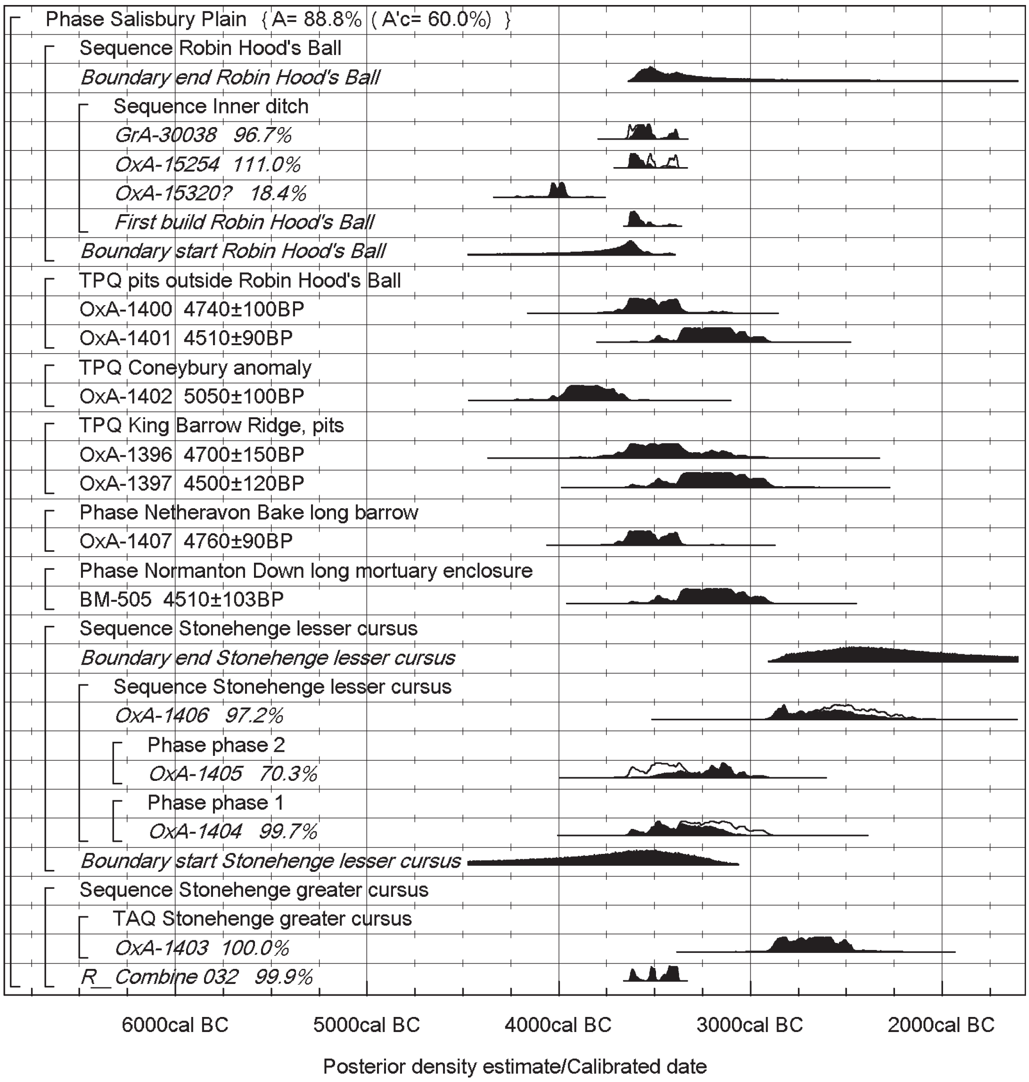


Fig. 4.51. Salisbury Plain. Posterior density estimates and calibrated dates for the Robin Hood's Ball causewayed enclosure and other archaeological samples dating from the fifth to fourth millennia cal BC. The format is the same as for Fig. 4.5. The models (where appropriate) are defined by the brackets down the left-hand side of the diagram, along with the OxCal keywords.

Table 4.12. Radiocarbon dates from Robin Hood's Ball, Wiltshire. Posterior density estimates derive from the model defined in Fig. 4.51.

Laboratory number	Sample reference	Material	Stratigraphic details	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Inner ditch							
OxA-15320	RHB I (65)	1 of two Neolithic Bowl sherds, probably from same vessel, with internal residue	In layer M, close to bottom of ditch (N. Thomas 1964a, fig. 3). Stratified below RBH I 74 The laboratory notes on the certificate that 'OxA-15320 produced a yield of 0.75 mg C from a burn-weight of 8.93 mg. In addition, the $\delta^{13}C$ value is more negative than usual. For these reasons, we give a health warning on the measurement.'	5199±35	−29.4	4050–3950	
OxA-15254	RHB (I) 74	Neolithic Bowl sherd with internal residue extracted from larger find	On the surface and in the very top of layer M, overlain by layers K and L (N. Thomas 1964a, fig. 3). The sample formed part of a spread of sherds, some joining, and of bone, on what would have been a temporary surface. Stratified below RHB I (50) and above RHB I (65)	4732±30	−27.0	3640–3370	*3640–3500 (91%)* or *3430–3400 (4%)*
GrA-30038	RHB I (50)	The largest of three Neolithic Bowl sherds, 2 of them with internal residue	At interface of layers K and G (N. Thomas 1964a, fig. 3). Stratified above RHBI (74)	4765±40	−29.9	3650–3370	*3625–3495 (77%)* or *3430–3375 (18%)*

Objectives of the dating programme

Alongside confirming the Neolithic date of the enclosure, our objective was better to define its place in the sequence of fourth millennium cal BC construction and other activity in the area in which Stonehenge was later to be built.

Sampling strategy

Sampling was severely restricted by the limited scale of the excavation, the original paucity of finds from the outer ditch and our inability to locate any of the faunal remains or charcoal. This is particularly disappointing since it is recorded that 'the joints of several long bones were still in articulation when discovered' (N. Thomas 1964a, 20). Samples were therefore confined to three sherds of Neolithic Bowl from the inner ditch with carbonised residues adhering to their interior surfaces.

Results and calibration

Details of the radiocarbon measurements from Robin Hood's Ball are provided in Table 4.12.

Analysis and interpretation

Three samples were dated from the inner ditch (Fig. 4.51). The earliest of these, on one of two sherds probably from the same vessel (OxA-15320), came from chalk rubble close to the base of the ditch. Later than this was another residue (*OxA-15254*) on a sherd recovered from a spread of pottery on the surface and in the very top of the same rubble. Higher up the sequence of fills another residue was dated (*GrA-30038*), on the largest of three bowl sherds which were found together.

Unfortunately, the residue on RHB I (65) (OxA-15320) produced an extremely low yield of carbon (0.75 mg from the 8.93 mg of pretreated material combusted), which may suggest that the 'residue' was in fact staining from the surrounding soil rather than the remains of carbonised food. Consequently, it is unlikely that this result provides an accurate date for the sherd and it has been excluded from the chronological model for this site (Fig. 4.51). The other two determinations are in good agreement with their recorded stratigraphic sequence, although dating based on so few samples cannot but be tentative.

The model shown in Fig. 4.51 suggests that the inner ditch at Robin Hood's Ball was constructed in *3640–3500 cal BC* (*91% probability*; Fig. 4.51: *build Robin Hood's Ball*) or *3430–3400 cal BC* (*4% probability*), probably in *3635–3570 cal BC* (*68% probability*). As it is based on so few samples, this estimate is highly tentative. It is also not possible reliably to estimate the duration of activity at the enclosure with so few samples.

Implications for the site

With so little fieldwork having taken place at Robin Hood's Ball, the date estimates now available do not lead

Table 4.13. Fifth and fourth millennium radiocarbon dates from Salisbury Plain, Wiltshire. Posterior density estimates derive from the model defined in Fig. 4.51.

Dates on charcoal from beneath the bank of Durrington Walls (Wainwright and Longworth 1971, 9, 14), are omitted because it is not clear whether they related to this period or were measured on mature wood burnt in the third millennium cal BC.

Laboratory number	Sample reference	Material	Stratigraphic details	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Pits outside Robin Hood's Ball								
OxA-1400	W83, 147, 105	Cattle. Otherwise unidentified bone sample	From pit containing Bowl pottery in activity area outside causewayed enclosure (J. Richards 1990, 61)	4740±100	−21		3710–3340	
OxA-1401	W83, 199, 227	Cattle. Otherwise unidentified bone sample	From pit containing Bowl pottery in activity area outside causewayed enclosure (J. Richards 1990, 61)	4510±90	−21		3510–2910	
Coneybury Anomaly								
OxA-1402	W2, 1981, IL, 2538, 420	Animal bone	Context 2538. Deposit in base of large pit, exceptionally rich in artefacts, animal bone and charcoal (J. Richards 1990, 40–61)	5050±100	−21.0 (assumed)		3950–3790	
Netheravon Bake long barrow								
OxA-1407	W85, A, 42, 7	Antler	Base of phase 1 ditch of long barrow with two successive sets of flanking ditches (J. Richards 1990, 259)	4760±90	−21.0 (assumed)		3640–3520	
King Barrow Ridge								
OxA-1396	W59, K, 375	Animal bone (J. Richards 1990, 259) or antler (R. Hedges *et al.* 1989b, 220)	Area C, pit 418, context 523 (equivalent to 498). Basal fill of a pit rich in pig bone and containing Grooved Ware pottery and one Peterborough Ware sherd (J. Richards 1990, 114–23)	4700±150	−21.0 (assumed)		3630–3370	
OxA-1397	W59, C, G23, 411	Animal bone	Area J/K, pit 440, context 516/519. Dark layer above sterile basal silts of a pit, containing articulated cattle vertebrae and additional bones of other species, overlain by an upper fill containing plain sherds in Peterborough Ware fabrics with one Grooved Ware sherd (J. Richards 1990, 114–23)	4500±120	−21.0 (assumed)		3340–3100	
Lesser Stonehenge cursus								
OxA-1404	W55, A, 51, sf 219	Red deer. Heavily eroded antler fragment	Area A, ditch 44, context 51. Primary chalk rubble fill of ditch subsequently cut by ditch which extended monument to east. Phase 1 (J. Richards 1990, 72–93, fig. 45)	4550±120	−21.0 (assumed)		3360–3130	*3635–3555* (*8%*) or *3540–3100* (*87%*)
OxA-1405	W55, A, 21, sf 7	Red deer. Antler rake used for groove-and-splinter (J. Richards 1990, fig. 55)	Area A, ditch 10, context 21. With other antlers on floor of ditch cutting ditch 44. Phase 2 (J. Richards 1990, 72–93, figs 45, 47)	4640±100	−21.0 (assumed)		3500–3360	*3500–3005* (*94%*) or *2980–2955* (*1%*)

Laboratory number	Sample reference	Material	Stratigraphic details	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-1406	W55, C, 320, sf 42	Red deer. Antler fragments	Area C, ditch 304, context 320. In cemented chalk rubble in secondary fills, possibly derived from slighting of bank (J. Richards 1990, 72–93, fig. 51)	4000±120	−21.0 (assumed)		2890–2140	*2895–2285*
Greater Stonehenge cursus								
OxA-17953	032	Battered frontal tine of red deer antler	Context 032, Tr 26, at base of western ditch terminal, below primary chalk rubble (J. Thomas *et al.* 2009)	4716±34	−21.70	4706±24 T'=0.2; T'(5%)=3.8; v=1	3630–3370	*3630–3585 (18%)* or *3530–3490 (21%)* or *3470–3370 (56%)*
OxA-17954	032	Replicate of OxA-17953	From same context as OxA-17953	4695±34	−21.59			
OxA-1403		Red deer. Antler	Base of ditch (Stone 1947, 14, fig. 3D)	4100±90	−21.0 (assumed)		2840–2580	*2890–2465*
Normanton Down long mortuary enclosure								
BM-505		Red deer. Protein separated from antler pick	Excavated 1959 from base of one of two short slots defining an entrance at the E end of the enclosure (Vatcher 1961, 163, fig. 3)	4510±103			3340–3100	

to extensive further implications for the site itself. Samples from the two pits excavated outside the enclosure could postdate the construction of the enclosure, although the earlier (OxA-1400) may be contemporary with its use. This of course assumes that the disarticulated bone samples were fresh when deposited in the pits. If they were not, the pits could be more recent.

Implications for the local setting

More can be said about the broader area of the Avon-Till interfluve and its environs (Table 4.13), and sometimes contradictory attempts have been made to define or minimise distinct zones of activity within it (e.g. J. Richards 1990, 265–7; Cleal *et al*. 1995, 473–6; J. Thomas 1999, 167–72), although there is some consensus that settlement evidence, as far as it is known, clusters in the south and east. Robin Hood's Ball, in other words, seems to be located on the edge of this focus of activity to the south and east (J. Thomas 1999, 170; Darvill 2005, map G), to which it may have been peripheral as Maiden Castle was to settlement and pasture in the Dorchester area.

A large pit on Coneybury Hill (J. Richards 1990, 40–61), comparable with those known at Roughridge on the North Wiltshire Downs (Chapter 3) and Rowden on the South Dorset Ridgeway (this chapter above), is not precisely dated. Only one sample has been dated from its rich basal deposit of artefacts, animal bone and charcoal (95% confidence; 3950–3790 cal BC; Fig. 4.51; Table 4.13: OxA-1402). Unfortunately the nature of the sample is unclear, beyond the fact that it was animal bone, so that the date can be treated only as a *terminus post quem* for the primary deposit. While the deposit seems to have been placed in the pit as an entity, some of its features suggest a longer chain of events. The fact that most of the pots were too incomplete to reconstruct and that at least two showed old breakage or wear (Cleal 1990a; 2004, 172) suggests derivation from a larger original source, and canid gnawing on some of the animal bone would be consistent with its having been buried some time, however short, after consumption. While at least seven roe deer seem to have been consumed nearby, on the basis of even representation of different skeletal elements, the less balanced remains of at least ten cattle, one pig and two red deer suggest that their major meat-bearing bones were removed for consumption elsewhere (Maltby 1990). Whether there was a single butchery and consumption event or a series of them, the period of accumulation was short enough for some bones to remain in articulation (Maltby 1990, 59), and a vast amount of meat was provided.

As at Rowden, the possibly early date of the deposit finds some support from the artefacts. The flint assemblage shows a higher level of blade production than that from the pits outside Robin Hood's Ball or than an *in situ* knapping cluster in the base of the phase I ditch of long barrow Amesbury 42 (P. Harding 1990b, fig. 149), both of them contexts which should date to the early to mid-fourth millennium cal BC. The variation may be functional, but,

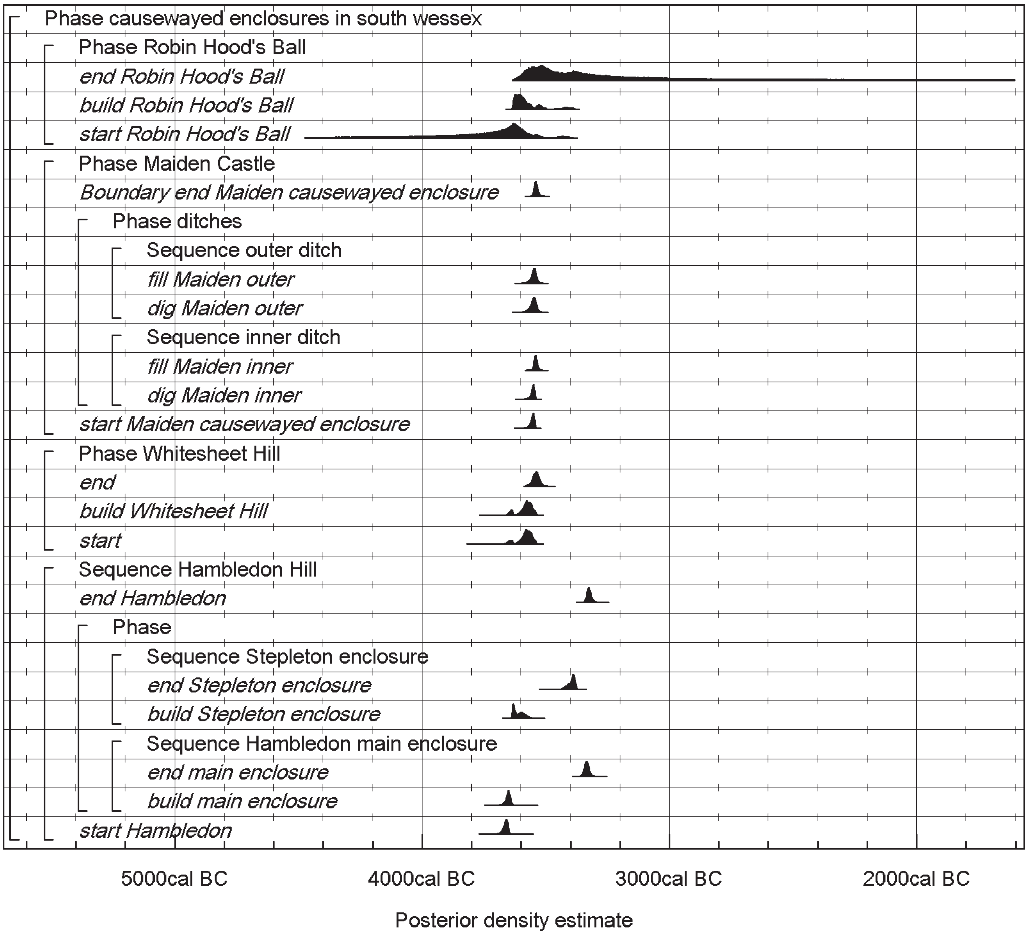


Fig. 4.52. Probability distributions of key parameters from causewayed enclosures in south Wessex, derived from the models defined in Figs 4.7–13 (Hambledon Hill), Fig. 4.26 (Whitesheet Hill), Figs 4.41–5 (Maiden Castle), and Fig. 4.51 (Robin Hood's Ball).

given a progressive abandonment of blade technology over time, it may also be chronological. Furthermore, the 1441 sherds from the primary deposit in the Coneybury Anomaly contrast sharply with the 230 sherds from the Robin Hood's Ball enclosure. The Coneybury sherds are overwhelmingly flint- and sand-tempered, with minimal amounts of other materials, of which shell (present in less than 1% of the sherds) is the only non-local one, and there is no true fineware component (Cleal 1990a, table 10, fig. 32). At Robin Hood's Ball, despite the smaller amount of pottery, gabbroic wares are present, over 20% of the sherds are in calcareous fabrics, and there is a wide range of miscellaneous inclusions, each identified in only a handful of sherds (N. Thomas 1964a, table 1).

The morphological contrast between the Coneybury and Robin Hood's Ball assemblages is as great as that between the Rowden and Maiden Castle ones. The 17 pots from Robin Hood's Ball illustrated by Thomas (1964a, fig. 4) are predominantly neutral and closed forms, with none of the widely-splayed rims which occur in the Coneybury assemblage which, while it has some South-Western traits, is not typical of that style (Cleal 1990a, figs 28–31). Coneybury, like Rowden, is among those assemblages which Cleal (2004) sees as potentially early. It is certainly distinct from the other Bowl pottery of the area which, where it is diagnostic, tends to conform to the Decorated Style, as at Fussell's Lodge (I. Smith 1966b, figs 5–6), beneath the bank of Durrington Walls (Wainwright and Longworth 1971, fig. 30), at Woodford G2 (on the evidence of heavy rims rather than of actual decoration: Harding and Gingell 1986, fig. 10: 1–3), Wilsford-cum-Lake (I. Smith 1991, fig. 13), Amesbury G39 (Cleal and Allen 1994, fig. 7: P21–27), a pit on King Barrow Ridge (Cleal and Allen 1994, fig. 8: P42), and Stonehenge (Cleal *et al*. 1995, fig. 193). The Robin Hood's Ball pottery is predominantly South-Western with some Decorated elements (N. Thomas 1964a, fig. 4; Cleal 1990c, 233–4), and sherds from a further pit on King Barrow Ridge conform to the South-Western style (Cleal 1990b, fig. 35). Forms similar to those from the Coneybury Anomaly may, exceptionally, be present among the pottery from beneath the bank of Woodhenge, although thickened rims and some decorated sherds are also present (Cunnington 1929, pl. 32: 43, pl. 34: 56–8; Cleal 1990c, 234). These may relate to an as yet unpublished assemblage described as Carinated Bowl, excavated in 2006 from a treethrow hole beneath the bank of the monument (Pollard and Robinson 2007, 164). The Coneybury assemblage remains exceptional in the area.

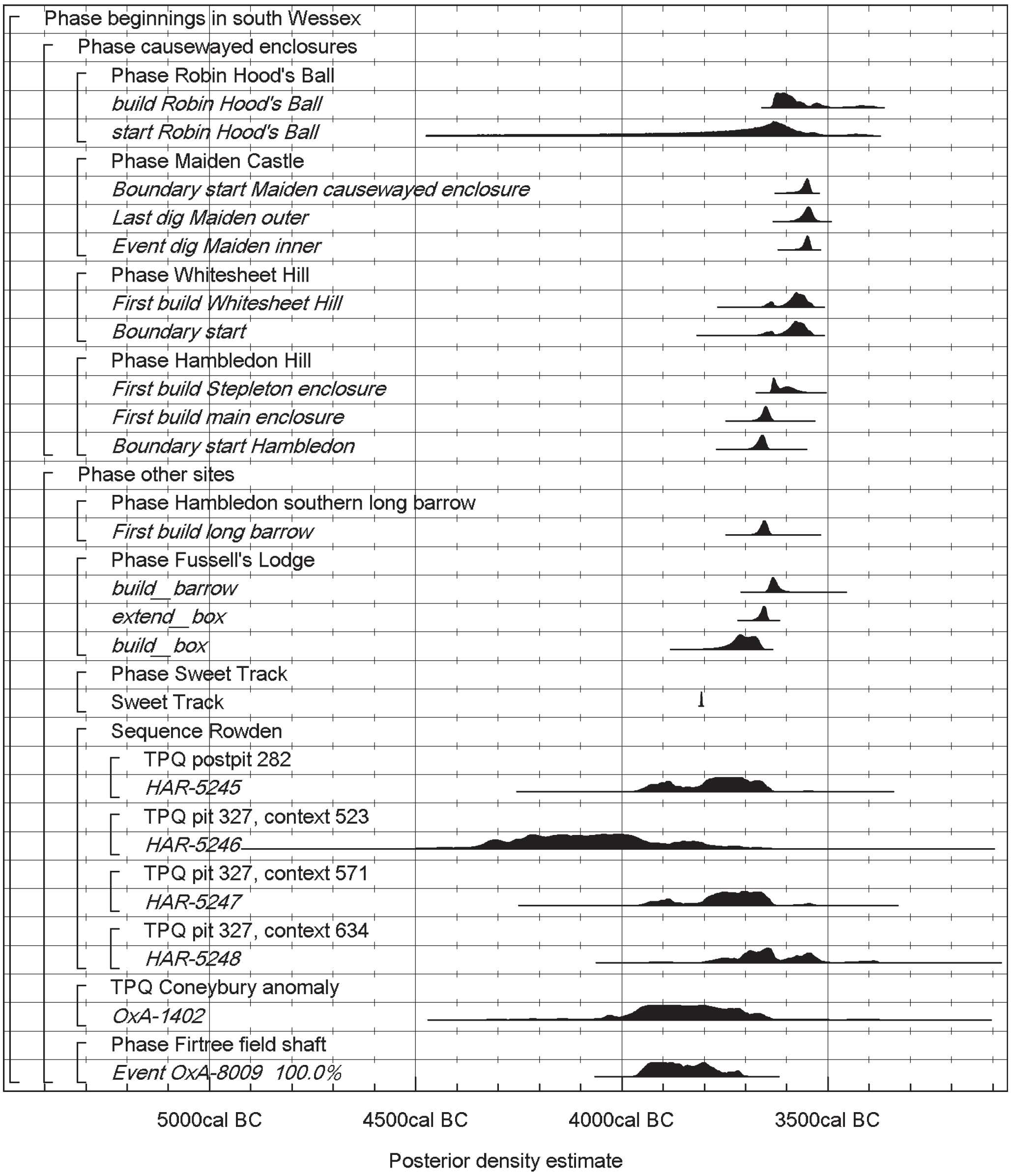


Fig. 4.53. Probability distributions of key parameters from causewayed enclosures in south Wessex and from potentially earlier Neolithic activity in the region, derived from the models defined in Fig. 4.21 (Fir Tree Field shaft), Fig. 4.51 (Coneybury Anomaly), Fig. 4.48 (Rowden), Wysocki et al. *(2007, figs 9–11; Fussell's Lodge), Figs 4.7–13 (Hambledon Hill), Fig. 4.26 (Whitesheet Hill), Figs 4.41–5 (Maiden Castle), and Fig. 4.51 (Robin Hood's Ball).*

Samples from other pits on King Barrow Ridge, this time associated with Peterborough Ware and Grooved Ware, have been dated to the mid- and later fourth millennium cal BC (Fig. 4.51; Table 4.13: OxA-1396–7); in the absence of precise information about the samples these results can be used only as *termini post quos*, reflecting no more than activity in the area at this time. A single antler sample (95% confidence; 3640–3520 cal BC; Fig. 4.51; Table 4.13: OxA-1407) has been measured from the Netheravon Bake long barrow, less than 2 km north-east of Robin Hood's Ball (M. Allen 1997b, pl. 2). The sample came from the base of the first-phase ditch (J. Richards 1990, 259). While several other long barrows on Salisbury Plain were opened by antiquaries in the nineteenth century (J. Thomas 1999, 170), none have been radiocarbon dated. Dating is underway for samples from the long barrow, Amesbury 42, at the east end of the Stonehenge cursus, excavated in 2008.

A single antler sample from a primary context at the east end of the Normanton Down long mortuary enclosure was dated to 3340–3100 cal BC (95% confidence: BM-505; Fig. 4.51; Table 4.13). This sample was processed and dated as described by H. Barker *et al.* (1971). All the other samples listed in Table 4.13 were processed by AMS as described by R. Hedges *et al.* (1989a). In all cases the protein fraction of bone and antler samples was dated.

A weathered antler sample from phase 1 of the Stonehenge lesser cursus was dated to *3635–3555 cal BC* (*8%*) or *3540–3100 cal BC* (*87% probability*; Fig. 4.51: *OxA-1404*), probably to *3520–3420 cal BC* (*24% probability*) or *3380–3180 cal BC* (*44% probability*). Another antler

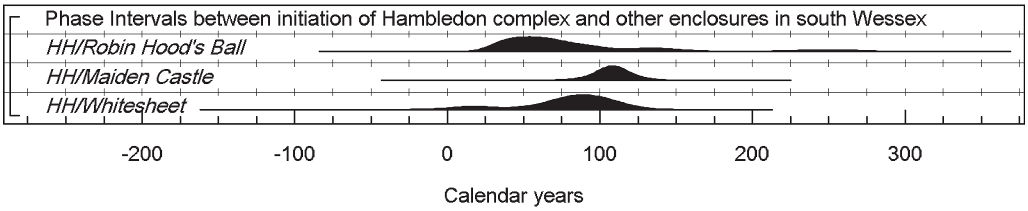


Fig. 4.54. Probability distributions of intervals between the initiation of the complex on Hambledon Hill and the construction of the first elements at the other dated causewayed enclosures in south Wessex, derived from the models defined in Figs 4.7–13 (Hambledon Hill), Fig. 4.26 (Whitesheet Hill), Figs 4.41–5 (Maiden Castle), and Fig. 4.51 (Robin Hood's Ball).

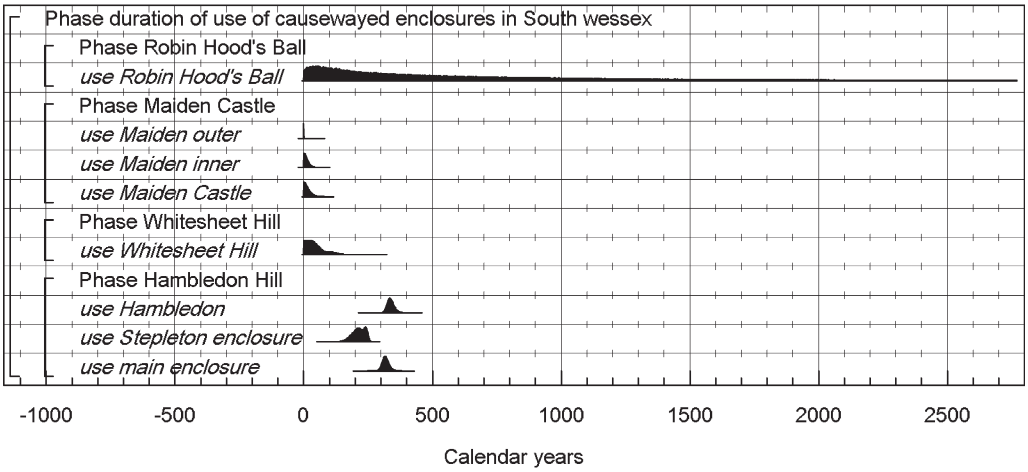


Fig. 4.55. Probability distributions of durations of primary use for the dated causewayed enclosures in south Wessex, derived from the models defined in Figs 4.7–13 (Hambledon Hill), Fig. 4.26 (Whitesheet Hill), Figs 4.41–5 (Maiden Castle), and Fig. 4.51 (Robin Hood's Ball).

sample from phase 2 was dated to *3500–3005 cal BC* (*94% probability;* Fig. 4.51: *OxA-1405*; Barclay and Bayliss 1999, 23) or *2980–2955 cal BC* (*1% probability*), probably to *3400–3335 cal BC* (*11% probability*) or *3275–3260 cal BC* (*2% probability*) or *3245–3085 cal BC* (*50% probability*) or *3060–3025 cal BC* (*5% probability*).

Finally, two statistically consistent (T'=0.2; T'(5%)=3.8; ν=1) radiocarbon measurements on a battered antler tine from the base of the western terminal ditch of the Greater Stonehenge cursus excavated during the course of the Stonehenge Riverside Project (J. Thomas *et al.* 2009) provide a date for its construction of *3630–3585 cal BC* (*18% probability*; Fig. 4.51: *032*) or *3530–3490 cal BC* (*21% probability*) or *3470–3370 cal BC* (*56% probability*), probably of *3620–3605 cal BC* (*8% probability*) or *3525–3495 cal BC* (*17% probability*) or *3435–3375 cal BC* (*43% probability*). An antler sample from the base of the cursus where excavated further along its length by Stone dates to *2890–2465 cal BC* (Fig. 4.51: *OxA-1403*), probably to *2870–2800 cal BC* (*16% probability*) or *2760–2565 cal BC* (*49% probability*) or *2515–2500 cal BC (3% probability)*. On the basis of this late date, it has been long suggested that this sample came from an unrecognised recut (J. Richards 1990, 96). This is all the more plausible given the existence of further pits on the line of the cursus revealed in the 2007 trenches. Julian Thomas *et al.* (2009, 52) have suggested that this constitutes some kind of coherent refurbishment of the monument, contemporary with the construction of the sarsen settings at Stonehenge and of the South Circle at Durrington Walls. Even accepting a date in the 26th or 25th centuries cal BC for the sarsen settings at Stonehenge (Parker Pearson *et al.* 2007, fig. 6) – and there are alternative models which suggest a slightly later date (Bayliss *et al.* 2007e) – the date for the refurbishment of the cursus provided by *OxA-1403* seems rather earlier and more in line with the Phase 2 wooden settings at Stonehenge (but note, of course, that all the previous Stonehenge phasings are now subject to potentially radical revision in the light of new results from the Stonehenge Riverside Project).

In summary, the data of diverse quality presented in Fig. 4.51 suggest that only the Coneybury Anomaly in the immediate area has a good chance of being earlier than the causewayed enclosure at Robin's Hoods Ball.

4.5 Discussion

Regional perspectives: beginnings

We are still far from possessing a reliable chronology for the first centuries of the Neolithic in this broad region. We have so far dated, with much greater precision, the

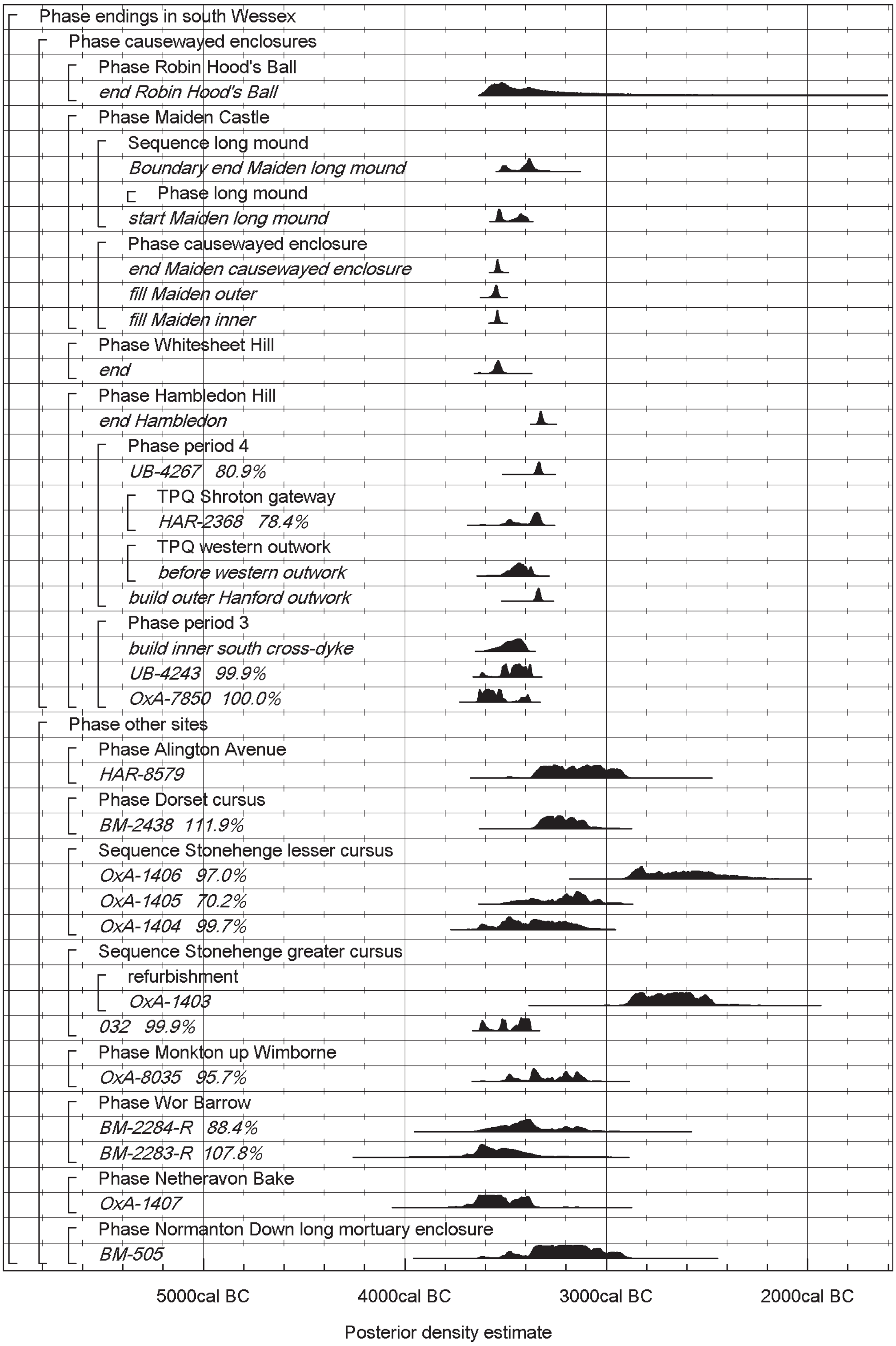


Fig. 4.56. Probability distributions of key parameters from causewayed enclosures in south Wessex and from potentially later Neolithic activity in the region, derived from the models defined in Fig. 4.20 (Dorset cursus, Monkton-up-Wimborne, Wor Barrow), Fig. 4.48 (Alington Avenue), Fig. 4.51 (Netheravon Bake, Normanton Down long mortuary enclosure, Stonehenge greater and lesser cursus), Figs 4.7–13 (Hambledon Hill), Fig. 4.26 (Whitesheet Hill), Figs 4.41–5 (Maiden Castle) and Fig. 4.51 (Robin Hood's Ball).

four causewayed enclosures analysed and discussed in this chapter – markedly so in the cases of Hambledon Hill and Maiden Castle, less so with Whitesheet Hill and Robin Hood's Ball – but it is difficult to find many other fixed points. None of the four dated causewayed enclosures existed before the 37th century cal BC (Fig. 4.52). Assuming for the sake of argument that Scratchbury, the other possible enclosure in this region (see above), is

of a similar date, what – if anything – can be proposed as earlier?

The site-related reviews above show that there is little activity which can be certainly assigned to the 38th century cal BC and earlier, even though much has been proposed for such a horizon. Neolithic material was probably deposited in the Fir Tree Field shaft in the first quarter of the fourth millennium cal BC (Fig. 4.53: *OxA-8009*). Further to the west in the Somerset Levels, some 35 km west of Whitesheet Hill, the Post and Sweet Tracks date to the end of the 39th century BC (Coles and Coles 1986; Hillam *et al*. 1990). The burials in the primary mortuary structure at Fussell's Lodge long barrow, just east of the Wiltshire Avon, are estimated to have accumulated from the end of the 38th or the start of the 37th century cal BC, and the barrow there was constructed probably in the *3630s or 3620s cal BC* (Fig. 4.53; Wysocki *et al*. 2007). We can note again the estimate for the date of the south long barrow at Hambledon Hill itself of the 37th century cal BC (Table 4.3; Fig. 4.10). That leaves most other features in the region very imprecisely dated. None of the other long barrows in the four major clusters in this region – around Stonehenge, east of Whitesheet, in Cranborne Chase and on the Dorset Ridgeway – can be said to be dated yet with any precision (Figs 4.20 and 4.51). As we have seen, the pits at Rowden and Coneybury (Fig. 4.53) are also imprecisely dated, though their associated pottery may speak for an early date, and these and others could belong earlier than the causewayed enclosures.

Rather than take this situation negatively, it will be more fruitful to be realistic, and accept that even in such an allegedly well researched region – the core of the Wessex that is so often contrasted with other parts of Britain and Ireland – there is a very long way to go before we can claim to understand fully even the outline of early Neolithic development. We can propose a tentative working model, in which Neolithic activity begins in the 39th century cal BC, to be followed by the first 'public' constructions in the form of the first trackways in the Somerset Levels by the end of the 39th century cal BC, and then the first long barrows perhaps from the 38th century cal BC (see also Whittle *et al*. 2007a), and then the causewayed enclosures in the 37th century cal BC. This is a gradualist perspective on the start of the Neolithic in this region.

Given the state of the evidence, we can nonetheless usefully discuss variation from the 37th century cal BC onwards, and it is possible that this diversity may reflect in some way an unevenness in Neolithic activity in earlier centuries. The enclosure complex on Hambledon Hill was initiated before the other three analysed and discussed in this chapter. For two or more generations it may have stood alone (Fig. 4.54). It may have been joined by Whitesheet Hill, some 25 km to the north, in the late 37th or more probably the early 36th century cal BC. Unfortunately we can only place Robin Hood's Ball between the mid-37th and the mid-36th centuries cal BC. Maiden Castle was constructed in the mid-36th century cal BC. As we have shown above, different life histories can be estimated (Fig. 4.55). The strongest contrast is between the long tale of Hambledon Hill and the short story, event-like in character, of Maiden Castle. Whitesheet Hill may also have been in use for a comparatively short period.

Can we make any sense of this chronological patterning? Can we relate the different life histories to variations across the region covered in this chapter? We can usefully take the spatial dimension first. In the current state of evidence, we can suggest that Hambledon Hill could have served a large area in the initial generations of its use, simply because there were no other sites of its kind in the region and because finds of pottery, querns and stone axes show contact from further afield, well beyond the site. For the sake of this initial discussion we are assuming, rather artificially, that people went preferentially to, or had first allegiance to, the enclosure closest to their main place or places of residence. This is not necessarily a straightforward argument, since we have also suggested above (and see Mercer and Healy 2008), that the Hambledon complex is oriented to begin with in a manner to define itself against views from the east and to leave itself open to the west, and that the material located on the site is of south-western character. There is also the claim (made for Maiden Castle: J. Evans *et al*. 1988) that causewayed enclosures could have been located in out-of the-way places, in order to contain dangerous rituals, and in this model they may perhaps not be so easily thought of as also serving much broader areas. But other things being equal, period 1 (if not also some of period 2) at Hambledon Hill could have served or been available to people living at least as far away as the Dorset Ridgeway, the south coast, the Somerset Levels, Salisbury Plain, and the valley of the Wiltshire Avon: until the orbit of other, probably contemporary, early enclosures was reached. The same considerations could apply if enclosures were seen as defensive refuges or positions.

If we then introduce the temporal dimension as well, we might be tempted to see a reduction – for varying lengths of time – in area served. It is possible that all four investigated enclosures were in simultaneous, active, use in the mid-36th century cal BC, with shortest distances between them of 25–30 km (Scratchbury lies in the gap between Whitesheet Hill and Robin Hood's Ball). Even then, however, any one enclosure might still have served a considerable area. There is no known or suspected enclosure between Hambledon Hill and the Sussex Downs, nor southwards down the Wiltshire Avon from Robin Hood's Ball to the south coast. Maiden Castle, we have shown, was only in use for a brief period. The finds from Hambledon Hill, moreover, indicate an intensification of contacts through the history of the site, which brought increasing quantities of objects from as far afield as Cornwall, the Dorset coast, the Mendips and the Jurassic Ridge (Healy 2004; Mercer and Healy 2008). Given this, the notion that enclosures served only an immediate catchment is far too simplistic. One might have thought of a possible pattern of relative infilling through time, but this was an uneven and unstable process. Hambledon Hill endured, to be joined by others, perhaps for comparatively brief interludes.

The biggest, unanswered, question perhaps, when

contemplating these temporal and spatial patterns, is why Hambledon Hill had such a complex development, such an accumulated scale and such a long use-life. As we have seen above, there are only hints of comparable outwork systems at the other enclosures in the region covered in this chapter, principally at Whitesheet Hill. In the current state of knowledge, there are no easy answers, but some possibilities can be aired. Perhaps there were underlying, as yet undetected, variations in the distribution of population across the region which determined that Hambledon Hill was placed in an area of significant density. As the evidence stands, this seems unlikely, although the nearby Cranborne Chase seems to have been more open than other areas of chalk downland at this time (French *et al.* 2007, 225–6). There was nothing predetermined about the duration of any enclosure, and nothing given in advance about the relations between people using different sites. The continued concentration of labour for construction and of activity surrounding use at Hambledon Hill could be thought of as simply contingent: the outcome of Neolithic events and politics. If the local generations that successively used Hambledon Hill were capable of periodic mobilisations of labour, that must speak for established pre-eminence in the region. Did these generations also tend to come out on top in episodic bouts of conflict? The evidence is ambiguous on this particular issue, since burnings and killings may not speak for victories, but on the other hand, the persistence of the complex points to long-term success. Perhaps the date estimates give us the clue here, in that the oldest enclosure site of the region became also the longest-lived monument in the region. If we are to explain at least some aspects of these sites in terms of spatially focused allegiances and alliances, then seniority may have been an important organising principle (rather than population density or particular resources). Hambledon Hill became the longest-lasting and biggest complex, *because* it was also the oldest. If a different model is preferred, with less conflict in it, the same principle of seniority may still apply. It was the place with greatest kudos, strongest sacred power, widest reputation, most varied and most numerous offerings and depositions from furthest afield, *because* it was also the oldest.

Regional perspectives: endings

The case of Maiden Castle suggests that even after a site had gone out of primary, active, use, it could still be remembered. There are some finds in the buried soil at the top of the inner ditch beneath the long mound (see above; we cannot entirely discount the possibility that these could be residual). Then the hilltop was chosen for the construction of the long mound after an uncertain interval, either a generation or four or five generations (Fig. 4.47). It is difficult to avoid the conclusion that there was some kind of connection – direct or indirect – between the two constructions, either because of still recognisable earthworks or because of local stories and memories.

The long mound was probably constructed either in the second half of the 36th century cal BC or in the latter part of the 35th century cal BC (Fig. 4.56). From the mid-35th to the mid-34th centuries cal BC, the complex on Hambledon Hill was further developed, in site periods 3 and 4 (the latter dating to the second half of the 34th century cal BC) (Fig. 4.14). It is difficult to correlate the respective events precisely, but the Maiden Castle long mound may well be coeval with the major Hanford and western outworks at Hambledon Hill, which, we argued above, could represent a closing of aspect to the west and an opening of a new orientation towards the east: towards Cranborne Chase. Now there need be no direct connection between the construction of the Maiden Castle long mound and period 4 at Hambledon Hill. There need also be no exact equivalence in date between the long mound and the Dorset cursus, and the former is reasonably well dated whereas the latter is not. Together, however, the dates from the long mound and the Greater Stonehenge cursus indicate when linear monuments had become established in this region (see also Barclay and Bayliss 1999).

So the last significant constructions at Hambledon Hill largely concerned the establishment of new delineations on the west side of the hill, and this could have been the period when some of the pre-existing long barrows in Cranborne Chase were linked by the construction of the cursus. Ritual, sacred or political pre-eminence seems to pass to Cranborne Chase, witnessed by the concentration of other smaller monuments next to the cursus such as the Monkton-up-Wimborne pit circle/shaft complex and by the Knowlton complex among others (Barrett *et al*. 1991; M. Green 2000; French *et al*. 2007).

There may still have been no clear correlation between the distribution and density of population and the siting of pre-eminent monuments in this phase, from the 34th century cal BC onwards. The coastal plain remains, as before, a candidate for other concentrations of population (Barrett *et al*. 1991; Gardiner 1988; Field 2008). Nor need the turn of events have been repeated in exactly similar ways in each part of the region covered by this chapter. On Salisbury Plain, the Greater Stonehenge cursus followed Robin Hood's Ball (*82% probable*) after an uncertain interval, although there is no great spatial shift involved. It is not clear, even in the Hambledon-Cranborne Chase case, whether the spatial shift need represent a political shift, or whether it was essentially the same existing social network that chose a new setting, in a new generation, for changing purposes. Neither in the case of Whitesheet Hill nor in that of Maiden Castle is there a known or suspected cursus monument nearby. Life went on in the area, as witnessed by ongoing, modest, trackway construction in the Somerset Levels (Coles and Coles 1992), and such continuity is a useful foil to the comings and goings at the great monument complexes.

Notes

1 As in other chapters, the name is far from satisfactory, but we retain it here *faute de mieux.*

2 Note added in press: see Bishop (2010) for a possible single-circuit example at Tarrant Launceston 15 in Cranborne Chase.

3 Note added in press: see Peacock *et al.* (2010) for a quern from pit T9, outside the enclosure to the east, now identified as coming from a source in central Normandy.

4 There were further arrowheads from Sharples' Trench I in this area, the discovery that some had been removed and sold coming too late to permit their recovery.

5 The possibility that the trenches planned in this area (Wheeler 1943, pl. III) were not excavated is reduced by an air photograph (Sharples 1991b, fig. 38) in which trenches across the west end of the north long mound ditch appear as areas of clean white chalk, as do trenches known to have been excavated.

6 This was a very small sample which produced a low yield after pre-treatment (2.85 mg) and a small target. This gave a low current in the AMS and so the result has been reported as an experimental measurement and should be used with caution.

7 The negative figures in this range are produced because we do not know which of the two circuits was constructed first.

5 Sussex

Frances Healy, Alex Bayliss and Alasdair Whittle

The South Downs are a continuation of the Wessex Chalk, running east from Hampshire to Beachy Head in Sussex (Fig. 5.1). They form a narrow upland, only some 15 km across, which is traversed and divided into blocks by small rivers running down to the Channel: from east to west the Cuckmere, Ouse, Adur and Arun, a pattern continued in Hampshire by the Meon, Itchen, Test and Avon. Between the South and North Downs lie the clays and sandstones of the Weald. In west Sussex there is a coastal plain of varying extent, formed of clays, brickearths, sands, gravels and solifluxion deposits (D. Field 2008; Fitzpatrick *et al.* 2008, 4–8), like those of the Langstone Harbour area to the west (Dix and Scaife 2000, 8–11). In the east of the county, rising Holocene sea levels would have flooded estuaries but would have had relatively little effect on the position of the coastline because the offshore contours are steep. In the west, where the offshore gradient is much gentler, both cliffs and coastal plain would have extended considerably farther south (Woodcock 2003, fig. 1.1). Indeed, the coastline at the start of the Holocene probably extended well south of the Isle of Wight (Allen and Gardiner 2000, fig. 56; 2007; Loader 2007). Woodcock sees the fourth millennium cal BC coastline as deeply indented, with peat growth in valley mouths, not unlike the area of Chichester harbour today, where the shelter of the Isle of Wight and a reversed direction of longshore drift have impeded the development of coastal barriers and spits, and hence of the silting that has blocked inlets farther east. Offshore peat beds and submerged forests are relicts of a more extensive coastal plain, some of which was lost to marine transgression at the end of the Bronze Age (Woodcock 2003, 4–8), as evidenced by middle and late Bronze Age activity in the present intertidal zone of Langstone Harbour, adjacent to Chichester harbour across the Hampshire border (Allen and Gardiner 2000, 206–14; 2007).

The area has varied archaeologies, with a long history

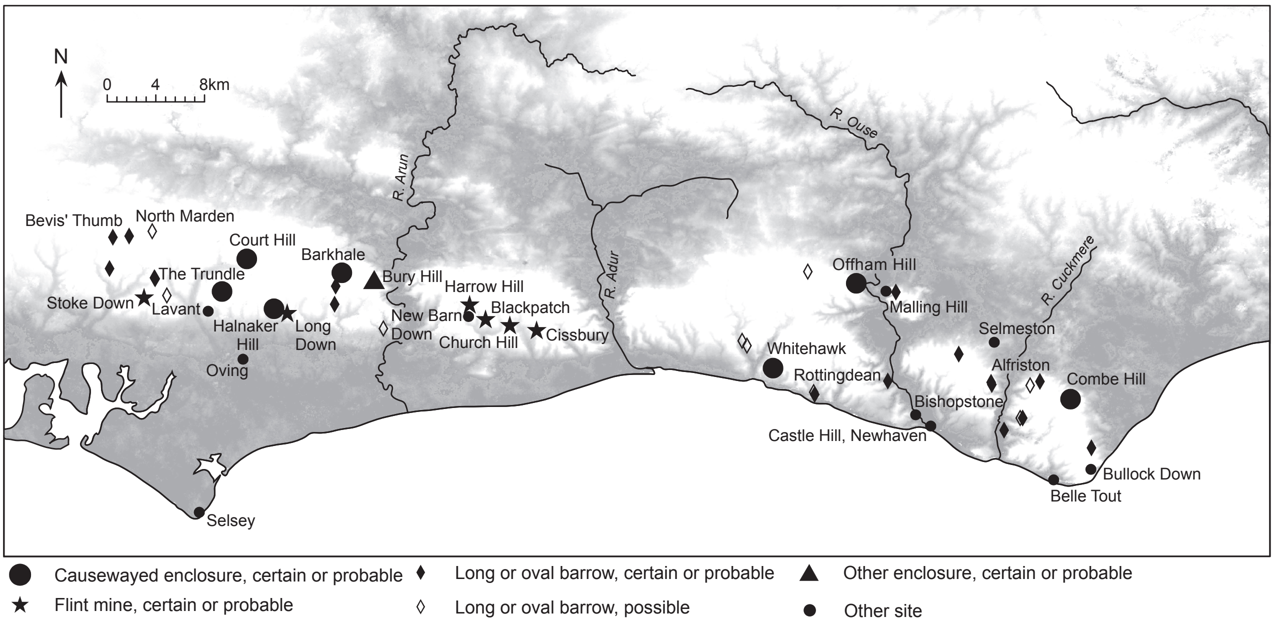


Fig. 5.1. Sussex showing causewayed enclosures, long barrows and other sites mentioned in Chapter 5.

of research. Later Mesolithic sites and finds extend beyond an earlier focus on the Weald on to the Downs and thinly on to the coastal plain (Jacobi 1978, 19; Pitts 1980; Gardiner 1984, 16–18; Holgate 2003, 35–6; D. Field 2008). In contrast, the early Neolithic sees a sharp focus on the Downs, with far less activity in the Weald (Gardiner 1984, 17–18; Drewett 2003, fig. 4.1). Here, as well as flint scatters, there are the long and oval barrows, flint mines and causewayed enclosures which for a long time constituted the Neolithic of Sussex. The flint mines have been investigated off and on since the days of Lane Fox and Canon Greenwell, notably in the inter-war period (M. Barber *et al.* 1999, 4–16; Russell 2001b). Excavation of the enclosures goes back to the great Sussex amateurs of the 1920s and 1930s and continued into the late twentieth century, notably through the work of the Sussex Archaeological Field Unit (now Archaeology South-East). It is worth remembering the view already formed by Cecil Curwen in the 1950s:

> To sum up: Whitehawk camp appears to have been the permanent headquarters of a tribe of Neolithic A people who were probably semi-nomadic herdsmen practising a little agriculture. They may have been cannibals, though they fed very largely on the ox, and they buried their dead with a minimum of ceremony in any convenient corner, or even threw them out with the rubbish (1954, 84).

The known Sussex enclosures all lie on the South Downs (Fig. 5.1). They appear geographically distinct, divided from sites to the north and north-east by the Weald and from sites to the west by a 100-km gap in the overall distribution (Fig. 1.1; Oswald *et al.* 2001, fig. 1.1). They fall into two clusters at present. To the east of the Adur, Whitehawk, Offham Hill and Combe Hill are loosely grouped with a number of known long barrows. Thirty km away, to the west of the river Arun, The Trundle, Court Hill, Barkhale, Bury Hill and perhaps Halnaker Hill are more tightly clustered, in this case to the east of a group of long barrows rather than coinciding with it. Some flint mines occupy the same area as this western group of enclosures (Fig. 5.1; Oswald *et al.* 2001, fig. 6.9; Drewett 2003, fig. 4.1). Further flint mines between the two groups of enclosures, in the downland block defined by the Adur and the Arun, are larger and more densely clustered.

The majority of the enclosures are causewayed. The main exception is Bury Hill, a near-continuous enclosure dated to the earlier fourth millennium cal BC (Bedwin 1981). Court Hill was also originally thought to be a continuous circuit but has been shown to have several certain and possible causeways (Oswald *et al*. 2001, 156). The apparent isolation of the Sussex enclosures, their current separation into two clear groups, and their total number must all be viewed with caution. There may be more which are not readily recognisable, and the gaps may be illusory. Accumulated environmental evidence, including molluscan analyses from the enclosures reviewed here, indicates that Sussex saw small, short-lived clearances of the woodland in the fourth millennium cal BC, as in the preceding centuries of the fifth millennium (Somerville 2003, 239–41).

5.1 Whitehawk Camp, Brighton, East Sussex, TQ 3303 0477

Location and topography

Whitehawk Camp lies on the eastern outskirts of Brighton, on the Upper Chalk, on a saddle between two slightly higher knolls, tilted towards the higher ground of the main body of the South Downs to the north-east, with which it is intervisible. The site overlooks the lower ground of the coastal plain to the south, with a particularly steep slope on its east flank (Oswald *et al*. 2001, fig. 5.25: C; Drewett 1994, fig. 14). Its proximity to the coast, currently just over 1 km to the south, is likely to have altered little, since east of Brighton the offshore sub-surface contours dip so steeply as to suggest that the present retreat of the cliff line here is a relatively recent phenomenon, as described above (Woodcock 2003, 4).

The enclosure consists of at least six and probably more earthworks, which are shown in Fig. 5.2 and summarised in Table 5.1. Unusual features include the presence of four circuits (Ditches I to IV, numbered from the innermost outwards); an *external* bank to Ditch II; two incomplete circuits, 2a and 3a, emerging from the west sides of Ditches II and III and possibly either truncating them or truncated by them (RCHME 1995a; Oswald *et al.* 2001, 76–7); and tangential ditches joining Ditch IV in the north-east and south-west. Several round barrows were eventually built in the surrounding area, although they have not survived (RCHME 1995a, 12; Russell and Rudling 1996, 47).

History of investigation

This section summarises the information presented in greater detail by the RCHME (1995a, 3–7). In 1821, the Reverend J. Skinner sketched a plan and a profile of the more conspicuous earthworks, including two concentric circuits (later known as Ditches III and IV), with an entrance through both in the north, and linear ditches running off Ditch IV (Oswald *et al*. 2001, figs 2.3, 5.30). An inner enclosure (later known as Ditch II) was noted by H.S. Toms in 1910. By the late 1920s the site had become a scheduled ancient monument. E.C. Curwen's survey of 1928, based on the work of the Ordnance Survey and enhanced by a combination of surface observation, bosing and air photograph interpretation, increased the three circuits already known to at least four by identifying an inner ditch and a possible fragment of ditch outside Ditch IV to the north. Curwen also showed that the banks were less frequently interrupted than the ditches and confirmed the presence of tangential ditches, running off Ditch IV to the north-east and south-west (Ross Williamson 1930, pl. I). This survey was a prelude to excavations in 1929 by the Brighton and Hove Archaeological Club under R.P. Ross Williamson, the aims of which were '. . . both to determine

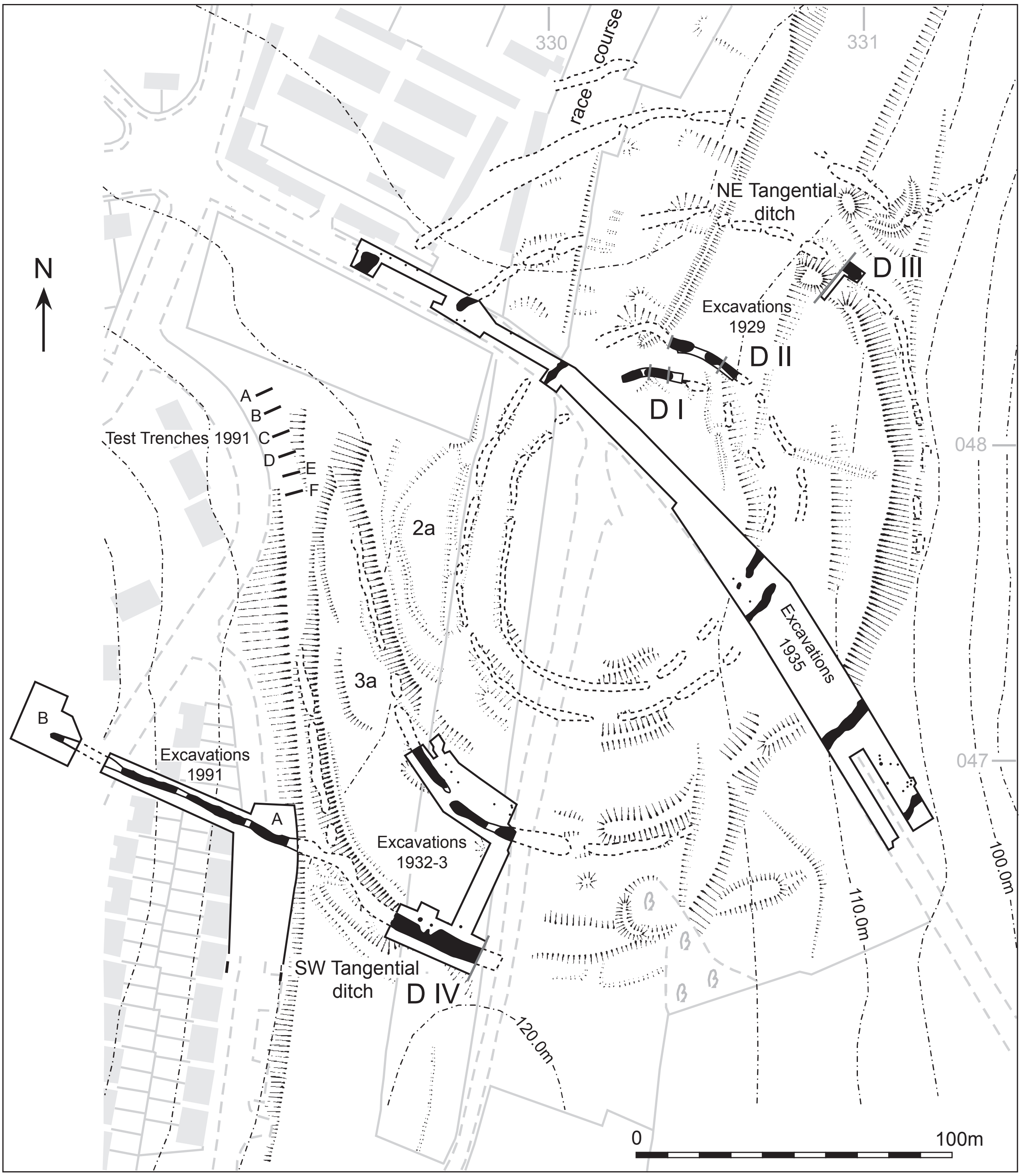


Fig. 5.2. Whitehawk. Plan combining the ditch lines defined by E.C. Curwen in 1928, the results of excavation and the 1993 RCHME survey. After Curwen (1934a, pl. XII; 1936, pl. I), Russell and Rudling (1996, fig. 2) and Oswald et al. *(2001, fig. 5.31).*

the date of the camp and to impress upon the public the importance of its preservation from an archaeological standpoint' (Ross Williamson 1930, 59). Ross Williamson excavated parts of the northern circuits of Ditches I and II and cut a single trench across Ditch III.

Subsequent investigations were early instances of developer funding, instigated because of the status of the site as a scheduled ancient monument. H.M. Inspector of Ancient Monuments twice required that excavation be undertaken in advance of destructive works, in 1932–3 because of levelling for an extension to the pulling-up ground of Brighton Race Course, funded by Race Stand Lessees, and in 1935 because of road building, funded by Brighton Corporation. Both were undertaken by E.C.

Table 5.1. Certain and possible pre-Iron Age features at Whitehawk, East Sussex.

Element	Notes	Investigation
Ditch I	‘Black mould’ (?in recut) in CI–CIII in N (Ross Williamson 1930, pl. III: sections A.B., C.D.), ‘Black triangle’ on site A in SE 1935 (Curwen 1936, 62–3, fig. C)	20 m excavated in N 1929, 13 m in SE 1935
Ditch II	External bank, of which best preserved fragment is apparently respected by Ditch II. Could it incorporate an earlier long barrow? ‘Black mould’ (?in recut) in CI–CV in N, not apparently in CIV–CVI (Ross Williamson 1930, pl. III: sections E.F., K.L.). ‘Black triangle’ on site A in SE 1935 in text but not in section (Curwen 1936, 63–4, fig. C). ‘light grey triangle of occupation debris’ (L3) on site B in NW, looks like secondary silt rather than fill of recut (Curwen 1936, 71, fig. E)	23 m excavated in NE 1929, 9 m in NW and 14 m in SE 1935
Enclosure 2a	Arc of bank abutting Ditch II, ?predating it. Apparently respected by enclosure defined by Ditch III	Recorded by RCHME 1993 (RCHME 1995a)
Ditch III	Immediately above steep slope into coombe on E Profile in NE could be compatible with recut (Ross Williamson 1930, pl. III: section G.H.). Profiles in SW are not (Curwen 1934a, fig. 2), although plan may be if earlier ditch almost completely removed by later one (Curwen 1934a, pl. XIV). Profile in SE is not (Curwen 1936, fig. C). Profile in NW shows external ledge, which could conceivably be shallower, earlier ditch ‘Culture layer’ present in SW, but no trace of recut. Less pottery than in DI and DII in N, little flint. 2 ‘culture layers’ in SE (L3, L1), with intervening chalk (L2; Curwen 1936, 65, fig. C). Similar sequence in NW, with addition of thin dark grey layer (L7) on base of ditch. Here the other two ‘occupation’ levels were L5 and L3 (Curwen 1936, 71, fig. E)	6 m excavated in NE 1929, 45 m in SW 1932–3, 7 m in NW and 18 m in SE 1935
Enclosure 3a	Arc of segmented ditch, 1 with internal bank, abutting SW of DIII Could any of the segments coincide with ‘hearth’ excavated in 1932–3?	Recorded by RCHME 1993 (RCHME 1995a)
Ditch IV	Never observed in E. May have run into head of scarp In SW, plan and profile support Curwen’s interpretation of slighter causewayed ditch recut by deeper, more continuous ditch (Curwen 1934a, pl. XIII, fig. 1) Smaller in SE than in SW or NW, no hint of recut in SE (Curwen 1936, fig. C) No ‘occupation layer’ in any cutting	30 m excavated in SW 1932–3, 7 m in NW and 10 m in SE 1935. Bank possibly encountered in trial trench in E 1991 (Russell and Rudling 1996, 48–9)
Fifth ditch?		Plotted in N 1929. Observed in SE 1935: ‘small ditch’ revealed in section as face of hill cut back for new road, 15–20 m SE of DIV (Curwen 1936, 69)

Element	Notes	Investigation
Sixth ditch?		Observed in SE 1935: 'small ditch' revealed in section as face of hill cut back for new road, approx. 40 m farther downhill from 5th ditch (Curwen 1936, 69)
SW tangential ditch	Traced for 90.5 m, continuous but for single butt end 12 m from edge of available landtake	Excavated in 1991, *c.* 40 m NW of Curwen's 1932–3 excavation of D4
NE tangential ditch	Six segments detected by geophysical survey, running into top of escarpment slope	Plotted 1928, subject of geophysical survey 1995
Row of pits or ditch segments on race course S of enclosure	Row of eight features with slight scarp to E, running N–S along centre line of racecourse	Recorded 1993 during earthwork survey. Some visible as parchmarks
Interior	Demonstrably or probably Neolithic features confined to one of a group of pits and postholes in SE between DIII and DIV (Curwen 1936, 69), adult male skeleton on surface of chalk between DI and DII in NW with 3 sherds Neolithic pottery. 2–3 mussel shells (Curwen 1936, 70), child skeleton with Neolithic sherds and incised chalk in posthole-like feature on or close to causeway in DIII, single pits within DI and between DII and DIII (Curwen 1936, 74–5)	Strip 30 m x 6 m between DIII and DIV cleared in 1932–3, transect 260 m long and 4 m–17 m wide from SE to NW cleared in 1935

Curwen and the Sussex Archaeological Society (Curwen 1934a; 1936). In the first of these two seasons Curwen excavated parts of the south circuits of Ditches III and IV, showing that both had probably been recut, that there was a post-built structure in an entranceway in Ditch III, and that Ditch III contained articulated burials. The flavour of these excavations is captured by Burstow's description (1942) of the discovery of a burial (Skeleton II) in Ditch III:

> At about four o'clock on a wintry afternoon we were working in the first section of Ditch 3 when suddenly a workman next to me began sending up great pieces of curved bone. I could not think what animal it might be, when it suddenly dawned on me that it was a human skull. We saw an eye-socket and that was enough. Out with our knives and we began carefully scraping. We found the arms and then the vertebrae. Hamilton hurried off and phoned to Dr Curwen. I went off on his bike to get some film for my camera. Half the skeleton was still under ground under the gas main which ran across the cutting and which really marked the end of our digging that way. When the doctor came we undercut this pipe and revealed the complete skeleton of an adult. . . . It was now a pitch dark winter's evening. The doctor had his camera on top of the pipe looking down into the grave. It began to rain and the wind howled ominously; sacrilege after four thousand years! Hamilton covered the back of the grave with a sheet of corrugated iron and climbed underneath. He lit a magnesium flare and the doctor, standing precariously on the exposed pipe, took a couple of photographs.

The 1935 season, in which a transect across the monument from south-east to north-west was investigated, saw the innovation of excavation by layers rather than by spits, undoubtedly a result of the presence of staff trained by Mortimer Wheeler (Curwen 1935, 61). The transect showed that internal pits and postholes were present, although scarce; that the banks of Ditches I, III and IV had timber substructures; and that articulated inhumations occurred in the interior as well as in Ditch III.

The excavations of 1929–35, together with those at Windmill Hill, made a major contribution to the definition of early Neolithic material culture. They yielded an abundance of artefacts. Curwen noted in his report on his second season at The Trundle that 70 or 80 lb [32 or 36 kg] of Neolithic pottery had been found at Whitehawk in the 1929 season alone (1931, 134). Stuart Piggott was later to define the Whitehawk style of Neolithic Bowl, like the Abingdon and East Anglian (or Mildenhall) styles, as a local development of the Windmill Hill style, which appeared closer to continental prototypes (Piggott 1954, 74). Ebbsfleet Ware, at the time referred to as 'hybrid ware', occurred at various levels in the ditches (Piggott 1934, 117–9; 1936, 80). Later activity, perhaps related to the now flattened round barrows, was principally represented by a concentration of Beaker pottery in and above a pit just outside Ditch III, with more of the same in the top of the adjacent ditch cutting (Ditch III, CVIII; Curwen 1934a, fig. 4).

In 1991–3 rescue excavations following the exposure of part of the south-west tangential ditch during building operations, as well as smaller-scale excavations and watching briefs in advance of other works, were undertaken by the Field Archaeology Unit of University College, London (Russell and Rudling 1996). The RCHME made a new earthwork survey in 1993 (RCHME 1995a; Oswald *et al*. 2001, fig. 5.31), supplemented by gradiometer and resistivity surveys of selected areas (Geophysical Surveys of Bradford 1993). The RCHME identified fragments of two further circuits in the west and south, 2a abutting the west side of Ditch II and 3a in a similar relation to the south-west of Ditch III. They also recorded a row of eight circular depressions, some also visible as parchmarks, with a shallow scarp to the east of them, running north-south roughly along the centre line of the racecourse, outside Ditch IV to the south. Resistivity survey in 1996 by the Ancient Monuments Laboratory covered an additional area (Funnell 1996).

The Whitehawk earthworks occupy at least 6 ha. Their extent remains uncertain, not least because the slope to the east is clearly covered with recently eroded material (Darvill and Fulton 1998, fig. 1.1). Curwen's observation during road building of two ditches downslope to the south-east of the known earthworks (1935, 69) shows that features may survive under this overburden. Whitehawk is one of the larger causewayed enclosures in England (Oswald *et al.* 2001, fig. 4.23). It is also among the most complex, both in the number of earthworks and in their possible relations to each other.

Previous dating

Some inferences had been made from the earthworks themselves. A kink in the northern part of Ditch II seems to respect a particularly substantial 16 m length of external bank, suggesting that the ditch may have respected a pre-existing earthwork, conceivably a long barrow (Ross Williamson 1930, pl. II; RCHME 1995a, 17). The incomplete circuit 2a may have truncated or been truncated by Ditch II and seems to be respected by Ditch III. The proximity of Ditches I and II and their similar scales and plans suggested that both might have been laid out together (RCHME 1995a, 16–17; Russell 1996, 57); both were furthermore richer in cultural material than Ditches III and IV, sharing what Curwen described as the 'black triangle', a finds-rich recut made after both were substantially silted (I. Smith 1971, 98; Mercer 1990, 57–8). Ditch III was in a similar relation to the incomplete circuit 3a as Ditch II was to 2a. The comparable scales and plans of Ditches III and IV suggested that they, like Ditches I and II, might have been laid out together (RCHME 1995a, 16–17; Russell 1996, 57).

Curwen's plan (1934, pl. XIII) strongly suggests that Ditch IV had been recut, with the concomitant removal of at least one causeway. This prompted Russell to conclude that the uncausewayed south-west tangential ditch, excavated some 40 m to the east in 1991, was a continuation of that recut (1996, 58, fig. 14). This had the advantage of explaining the contrast between the segmented north-east tangential ditch and the continuous south-west one. It ignored, however, indications that the south-west ditch might be of second millennium date. If the ditch excavated in 1991 is viewed in isolation, the only evidence for a Neolithic date is its pit-dug construction (Russell and Rudling 1996, fig. 4) and antler pick marks on its walls (Russell and Rudling 1996, 45). The rounded V-profile of the ditch (Russell and Rudling 1996, figs 5, 6, 7, 13) differs from the shallower and more splayed profiles of ditch IV (Curwen 1934a, fig. 1; 1936, figs C, E). There were no finds in the initial silt, a thin skin of rapidly accumulated silty clay, and few from the overlying fills of chalky loam with dense chalk and flint rubble, which would have accumulated rapidly. A flint industry from the overlying finer silt loam soils, which, if the rubble was rapidly accumulated, would have begun to be deposited soon after the ditch was dug, is technologically comparable to those of the Bronze Age (Underwood 1996), rather than to the fourth millennium lithics recovered from the enclosure ditches. The small amount of animal bone from the same fills includes a horse metapodial (from context 5; Wood 1996), and horse remains are rare in archaeological contexts in Britain before the Bronze Age (Serjeantson 1998).

Perhaps most significantly, the molluscan fauna, from bottom to top, was overwhelmingly made up of open-country species, especially those of short-turfed grassland. 'It is probable the ditch was dug in an open, essentially grassland environment, and that such habitats persisted throughout the unknown period over which the ditch filled in' (K. Thomas 1996, 53). Thomas notes that this contrasts with the composition of the few, predominantly shade-loving molluscs hand-collected from the circuits at Whitehawk during the excavations of the 1920s and 1930s. More significantly, it contrasts with the faunas analysed by him from other causewayed enclosures in Sussex, most of which seem to have been built in short-lived clearings in woodland (K. Thomas 1982). Only at The Trundle is there a hint of clearance prior to construction, and this was followed by regeneration (K. Thomas 1981a; 1982).

Single radiocarbon dates were obtained in 1981 by the Sussex Archaeological Field Unit for disarticulated bone samples excavated by Curwen from the chalk rubble fill in Ditches III and IV (Table 5.2: I-11846–7; Drewett *et al.* 1988, 35). Russell saw Whitehawk, The Trundle, Court Hill and perhaps other enclosures as initiated by at least 4200 cal BC (2001, 79, 114), the early origin for Whitehawk stemming from the consideration that, in the absence of dates for the inner circuits there, these could be as early as ditch II at The Trundle and the single circuit at Court Hill, for which there were radiocarbon results whose calibrated date ranges extend into the late fifth millennium (Table 5.5: I-11615–16; Table 5.6: I-12893).

Reassessment and modelling of existing dates

Both of the existing dates from Whitehawk were measured

Table 5.2. Radiocarbon dates from Whitehawk, East Sussex. Posterior density estimates derive from the model defined in Figs 5.5–9.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Ditch I									
GrA-26962	Brighton Museum R3162/169/N (1)	Red deer. Antler tine tip. Damage to the tine tip and an ancient break at tine base suggest that the sample formed part of an antler pick	Ditch I. Segment CI-CIII, cutting II, spit 6. This was the bottom spit and lay at 45–54 in (1.10–1.30 m; Ross Williamson 1930, 89, pl. III: section C–D)	4715±35	−23.8	5.73	4748±23 T'=1.6; T' (5%)=3.8; ν=1	3640–3380	*3635–3560*
OxA-14126	Brighton Museum R3162/169/N (2)	Replicate of GrA-26962	From the same context as GrA-26962	4774±31	−22.9				
OxA-14039	Barbican House Museum, Lewes 29.46/D	Internal residue surviving on lowest part of large, well preserved sherd of carinated Neolithic Bowl with faint channelling on lower body joining two others from DI CII 4	Ditch I. Segment CI-CIII, cutting III, spit 5. Spit 5 was the penultimate one and lay at 36–55 in (0.90–1.10 m; Ross Williamson 1930, 90, pl. III: section A–B)	4602±39	−27.6			3500–3130	*3520–3450*
GrA-26963	Barbican House Museum, Lewes 36.37/E	Internal residue from 1 of 5 Neolithic Bowl body sherds, from at least two separate vessels, in fairly fresh condition, all with internal residues	Ditch I. Segment CI-CIII, cutting I, spit 4. Spit 4 lay at 27–36 in (0.70–0.90 m; Ross Williamson 1930, 89, pl. III: section A–B)	4575±35	−29.5			3500–3120	*3515–3460*
OxA-14030	Barbican House Museum, Lewes 36.37/F	Internal residue from 1 of 4 sherds with residue, 3 possibly from same pot	Ditch I. Segment CI-CIII, cutting II, spit 4. Spit 4 lay at 27–36 in (0.70–0.90 m; Ross Williamson 1930, 90, pl. III: section C–D)	4809±29	−26.8			3650–3520	*3595–3520*
OxA-14157	Barbican House Museum, Lewes 36.37/G	Internal residue from 1 of 25 Neolithic Bowl body sherds. From different vessel to GrA-26965 and OxA-14040	Ditch I. Segment CVI, spit 3. There is no section of CVI; its average depth was 4 ft (1.22 m; Ross Williamson 1930, 61). Spit 3 lay at 20–30 in (0.50–0.75 m)	4846±32	−27.6			3700–3530	*3585–3525*
GrA-26965	Barbican House Museum, Lewes 36.37/H	Internal residue from 1 of 25 Neolithic Bowl body sherds. From different vessel to OxA-14157 and OxA-14040	From the same context as OxA-14157	4690±40	−29.1			3640–3360	*3625–3550* (*20%*) or *3540–3440* (*75%*)
OxA-14040	Barbican House Museum, Lewes 36.37/I	Internal residue from 1 of 25 Neolithic Bowl body sherds. From different vessel to OxA-14157 and GrA-26965	From the same context as OxA-14157	4725±65	−27.2			3650–3360	*3625–3455*
GrA-32367	Brighton Museum R 4100/143/V	Cattle. Metatarsal fragment articulating with navicular-cuboid to which 2nd and 3rd tarsals fused	Site A, DI, layer 2. Typed on envelope: 'WHITEHAWK (East) EXCAVATIONS 26th Oct., 1935. Ditch 1. Level 2, black earth. OX, bones and teeth of' (Curwen 1936, 62–3, fig. C)	4805±35	−22.1			3660–3520	*3600–3520*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Ditch II									
OxA-14031	Brighton Museum/A	Internal residue from Neolithic Bowl body sherd in fresh condition	Ditch II. Site B, layer 5. Layer 5 does not figure in the published description or section of this ditch (Curwen 1936, 70–1, fig. E: first section). The fill is, however, described as consisting of 'four principal layers', which leaves open the possibility of others, and layer 5 is given as the context on the envelope in which the sherd was stored. Since layers were numbered from the top, it would have lain between layer 4 and the base of the ditch. This context must date to very shortly after the original digging of the segment	4897±29	−25.3			3710–3630	*3675–3630* (*72%*) or *3580–3570* (*1%*) or *3565–3535* (*22%*)
GrA-26966	Skeleton III. Brighton Museum R 4100/139 221788/U (1)	Human. Mandible from articulated skeleton of middle-aged male	Site B, between DI and DII 'lying on the surface of the undisturbed chalk and covered only by a foot of topsoil'. Contracted, head to E, face to N, hands in front of face. Accompanied by 3 sherds Neolithic pottery, land molluscs, 2–3 mussel shells near head (Curwen 1936, 70). The skeleton was 3 m from the inner lip of DII. If DII once had an internal bank, as well as the external one observed by RCHME, then the skeleton would have lain in the area of that bank	4605±40	−21.2		4680±27 T'=6.2; T' (5%)=3.8; ν=1	3625–3365	*3630–3595* (*12%*) or *3530–3430* (*83%*)
OxA-14061	Skeleton III. Brighton Museum R 4100/139 221788/U (2)	Replicate of GrA-26966	From the same context as GrA-26966	4739±36	−20.3	10			
GrA-32365	Brighton Museum R4100/143/W(1)	Cattle. L astragalus articulating with unfused distal tibia fragment. Replicate of OxA-16287	Site B, Ditch II, layer 3. Typed onto envelope containing these and one other bone 'WHITEHAWK (West) excavations 29th Oct., 1935. Ditch 2, Level 3, light grey. OX, Bones of.' Sketch section in Curwen's 'Field-Book' shows L3 as 'light grey', labelled 'occupation level' above L4 'chalk slip'. Described in report as 'a light grey triangle of occupation debris, containing a large quantity of animal bones, some worked flints, but very little pottery' (Curwen 1936, 71, fig. E)	4780±35	−21.4		4802±24 T'=0.7; T' (5%)=3.8; ν=1	3650–3520	*3645–3625* (*13%*) or *3595–3520* (*82%*)
OxA-16287	Brighton Museum R4100/143/W(2)	Cattle. L distal tibia epiphysis articulating with astragalus. Replicate of GrA-32365	From same articulation, same find and same context as GrA-32365	4822±34	−21.2				

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
GrA-32364	Brighton Museum R3162/AA(1)	Cattle. Distal R radius fitting an unfused epiphysis. Replicate of OxA-16286	Ditch II, segment CIV+CVI, CIV, spit 4. Spit 4 lay at 27–36 in (0.68–0.91 m) deep (Ross Williamson 1930, 94) and the segment was 3 ft (0.90 m) deep. Spit 4 must have been on or close to the base, although a very few finds are recorded from spit 5, which did not reach the full spit depth of 9 in. There is no mention of any 'black mould' in this segment (Ross Williamson 1930, 94–5), nor is any shown on the one published section (Ross Williamson 1930, pl. III: section K–L)	4785±35	−20.5		4788±25 T'=0.0; T' (5%)=3.8; ν=1	3650–3520	*3640–3620* (*10%*) or *3605–3520* (*85%*)
OxA-16286	Brighton Museum R3162/AA(2)	Cattle. Unfused R radius epiphysis fitting distal radius fragment. Replicate of GrA-32364	From the same context as GrA-32364	4790±35	−20.4				
OxA-16285	Brighton Museum R3162/Z	Cattle. Cervical vertebra articulating with another from DII CI S2, epiphyses unfused	Ditch II, segment CI+CII+CIII+CV, CII, spit 3. CI and CII were contiguous arbitrary sections and spits 2 and 3 were contiguous arbitrary spits (Ross Williamson 1930, pls. II, III). Spit 3 lay at 18–27 in and was 9–10 in deep. Ross Williamson's section E–F (1930, pl. III) shows spit 3 as the lowest, straddling 'black mould' and primary chalk rubble. The 'black mould' seems the most likely context, since finds were concentrated in it (Ross Williamson 1930, 61)	4804±33	−21.7			3660–3520	*3650–3620* (*15%*) or *3605–3520* (*80%*)
OxA-16368	Brighton Museum R3162/Y	Cattle. 1 of 2 articulating lumbar vertebrae, epiphyses fused	From the same context as OxA-16285	4832±35	-22.4			3650–3540	*3660–3625* (*30%*) or *3595–3520* (*65%*)
GrA-32362	Brighton Museum R3162/X	Pig. R distal tibia fragment articulating with astragalus	Ditch II, segment CI+CII+CIII+CV, CI, spit 2. Spit 2 lay at 9–18 in (0.22 m–0.45 m) deep. Ross Williamson's section E–F (1930, pl. III) shows spit 2 straddling tertiary fill, 'black mould', and primary chalk rubble. The 'black mould' seems the more likely context, since finds were concentrated in it (Ross Williamson 1930, 61)	4740±35	−21.0			3640–3370	*3635–3495*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Ditch III									
OxA-14178	Brighton Museum/C (1)	Goat. Humerus articulating with radius from subadult individual. Animal bone from this spit includes elements from 2 goats, this one represented by at least 10 long bones and a scapula	Ditch III. Cutting CI, spit 6. Spit 6 was the penultimate spit and lay in chalk rubble at 50–60 in (1.30–1.50 m) from the surface and 18–28 in (0.45–0.70 m) above the uneven base of the ditch, beneath the 'occupation layer' (Ross Williamson 1930, 96; pl. III: section G–H). The number of bones recovered from a single individual makes it possible that the entire skeleton was present, given that excavation by pick and shovel did not make for complete bone retrieval	4755±32	−21.2		4757±26 T'=0.0; T' (5%)=3.8; ν=1	3640–3380	*3640–3560*
GrA-27330	Brighton Museum/C (2)	Replicate of OxA-14178	From the same context as OxA-14178	4760±45	−21.9				
I-11846		Cattle. Femur	Ditch III. Segment CVI–CVIII. Cutting VII. In 'coarse chalk rubble'. This was the lowest layer recorded in the ditch (Curwen 1934a, fig. 3: section VI)	4700±130				3710–3090	*3660–3555*
GrA-26971	Skeleton I. Brighton Museum R3688/128/S	Human. Rib fragment from articulated skeleton of female, 25–30 years old	Ditch III. Segment CII, in 'occupation layer'. Articulated (Curwen 1934a, fig. 2: section I, marked 'S')	4795±40	−20.7	10.03		3660–3380	*3615–3515*
GrA-26977	Skeleton IIa. Brighton Museum R3688/129/T (1)	Human. Rib fragment from articulated skeleton of female 20–25 years old	Ditch III. Segment CIII–CV. Cutting V, in 'lower part of occupation layer' (Curwen 1934a, 108–10, pl. XIV, fig. 2: section III, pl. XVII: 2). Articulated, with articulated remains of infant, in elongated oval area surrounded by chalk blocks with 2 perforated chalk fragments, covered with soil to top of blocks	4785±40	−21.1	9.67	4789±25 T'=0.0; T' (5%)=3.8; ν=1	3650–3520	*3600–3520*
OxA-14063	Skeleton IIa. Brighton Museum R3688/129/T (2)	Replicate of GrA-26977	From the same context as GrA-26977	4792±33	−20.6	9.9			
GrA-26969	Brighton Museum R3688/74/G	Internal residue from plain Neolithic Bowl body sherd	Ditch III. Segment CIII–CV. Cutting IV, spit 5H (= 'spit 5 hearth'). Hearth with pottery and human and animal bone in 'occupation layer' (Curwen 1934a, 111; pl. XIV; fig. 2: sections II and III). Spit 5 lay 40–50 in (1–1.27 m) below the surface	4660±35	−30.3			3630–3360	*3625–3595* (3%) or *3530–3430* (92%)
OxA-14145	Brighton Museum R3688/124/I (1)	Single fragment of *Quercus* sp. ?sapwood charcoal extracted from find that consisted mainly of bone	From the same context as GrA-26969	4844±34	−24.4			3700–3530	*3590–3525*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	δ^{13}C (‰)	δ^{15}N (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-27328	Brighton Museum R3688/124/I (2)	Single fragment of *Quercus* sp. ?sapwood charcoal extracted from find mainly of bone	From the same context as GrA-26969 and the same find as OxA-14145	4955±45	−24.7			3910–3640	
OxA-14204	Brighton Museum R3688/125/J (1)	Single fragment of *Corylus avellana* charcoal extracted from find predominantly of oak	From the same context as GrA-26969 and the same find as GrA-27325	4729±32	−25.9			3640–3370	*3630–3490*
GrA-27325	Brighton Museum R3688/125/J (2)	Single fragment of Pomoideae charcoal extracted from find predominantly of oak	From the same context as GrA-26969 and the same find as OxA-14204	4770±45	−25.4			3650–3370	*3620–3495*
GrA-26976	Brighton Museum R3688/73/E (1)	Possible internal residue from Neolithic Bowl body sherd. Replicate of OxA-14041	Ditch III. Segment CIII-CV. Cutting V. Spit 5. Spit 5 lay 40–50 in (1–1.25 m) below the surface and partly coincided with the 'occupation layer'. From the same find as OxA-14041	4710±45	−31.0		4722±43 T'=0.6; T' (5%)=3.8; ν=1	3640–3370	*3630–3480* (*93%*) or *3470–3450* (*2%*)
OxA-14041	Brighton Museum R3688/73/E (2)	Possible internal residue from Neolithic Bowl body sherd. Replicate of GrA-26976	From the same context and the same find as GrA-26976	4820±130	−29.9				
GrA-27327	Brighton Museum R3688/127/L (2)	Single fragment cf *Cornus* sp./*Viburnum* sp. charcoal extracted from find predominantly of oak	Ditch III. Segment CVI-CVIII Cutting VII spit 6. Spit 6 lay at 60–70 in (1.50–1.75 m) below the surface and partly coincided with the 'occupation layer' (Curwen 1934a, fig. 2: sections IV and V)	4775±45	−25.5			3650–3370	*3620–3495*
OxA-14144	Brighton Museum R3688/127/L (1)	Single fragment cf *Corylus avellana* charcoal extracted from find predominantly of oak	From the same context and the same find as GrA-27327	4835±33	−25.5			3700–3530	*3590–3525*
OxA-14143	Brighton Museum R3688/122/H (1)	Single fragment of *Quercus* sp. sapwood charcoal extracted from find which was entirely of oak	Ditch III. Cutting II spit 4. Spit 4 lay 30–40 in (0.75–1 m) below the surface, and would have been above skeleton I and the 'occupation layer' if spits were measured from the disturbed surface rather than from a level below it (Curwen 1934a, fig. 2: section I). From same find as GrA-27326	4941±39	−23.9			3800–3640	
GrA-27326	Brighton Museum R3688/122/H (2)	Single fragment of *Quercus* sp. ?sapwood charcoal extracted from find entirely of oak	From the same context and the same find as OxA-14143	4995±45	−24.0			3950–3650	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
OxA-14062	NHM 1970.3068	Cattle. Proximal phalanx articulating with medial phalanx, which in turn might articulate with unprovenanced distal phalanx	From the same context as OxA-14143	4785±35	−21.5		4761±28 T'=1.3; T' (5%)=3.8; ν=1	3640–3380	*3615–3510*
GrA-29363	NHM 1970.3068/2	Replicate of OxA-14062	From the same context as OxA-14062	4720±45	−20.9				
GrA-26975	Barbican House Museum, Lewes 36.37/M (Horniman 3941)	Possible internal residue from plain Neolithic Bowl sherd among several others	Ditch III. Segment CIII–CV. Cutting V. Spit 3. Spit 3 lay 20–30 in (0.50–0.75 m) below the surface in secondary silts (Curwen 1934a, fig. 2: section III)	4965±40	−27.5			3910–3650	
GrA-26967	Brighton Museum R3688/71/D	Internal residue from Neolithic Bowl body sherd	Ditch III. Segment CVI–CVIII. Cutting VII. Spit 3. Spit 3 lay at 20–30 in (0.50–0.75 m) below the surface in secondary and ?tertiary silts (Curwen 1934a, fig. 2: sections IV and V)	4545±35	−29.3			3370–3090	
Ditch IV									
GrA-26972	Brighton Museum R3688/138/B	Label: 'Proximal end of right tibia of ox, found with skeleton of roe deer, Whitehawk, Jan 1933'. In weathered condition	Ditch IV. Segment CV–CVI. Cutting V. Hole 5. Found with near complete articulated skeleton of roe deer (missing April 2004) in pit cut into surface of fairly low causeway truncated by recutting of ditch IV. 'The south wall of the hole was partly broken away' suggests that it may have been truncated when the ditch was recut (Curwen 1934a, pls XII, XV; fig. 1: section IV)	4830±40	−21.8	5.5		3700–3520	*3705–3620* (*80%*) or *3605–3540* (*15%*)
I-11847		Cattle. Femur	Ditch IV. Segment CV–CVI. Cutting V. In 'coarse chalk rubble'. This was the lowest layer recorded in the ditch (Curwen 1934a, fig. 1: sections IV–V)	4645±95				3640–3090	*3620–3445*
GrA-29364	Brighton Museum R4100/141/P/2	Red deer. Antler tine tip, anciently broken from beam	Ditch IV. Site A. DIV layer 4. In the lowest fill of the ditch (Curwen 1935, fig. C), which is likely to have accumulated within a couple of years of its originally having been dug	4720±45	−20.9		4677±28 T'=1.5; T' (5%)=3.8; ν=1	3630–3360	*3620–3600* (*2%*) or *3530–3430* (*93%*)
OxA-14065	Brighton Museum R4100/141/P	Replicate of GrA-29364	From the same context as GrA-29364	4650±35	−20.2				

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-26973	Brighton Museum R3688/139/M (1)	Red deer. Probable antler pick, weathered. Base and beam. Brow and bez tines broken off, brow ?recently, bez anciently. Numerous small antler fragments from the same spit in the same cutting suggest that the complete pick (even a second pick?) was present at the time of excavation	Ditch IV. Segment CV–CVI. Cutting V. Spit 7. CV was of uneven depth, so that spit 7, at 60–70 in (1.50–1.75 m) below the surface, would have been in coarse chalk rubble on the bottom of the ditch in the east of the cutting (Curwen 1934a, fig. 1: section IV) and would have been well in the middle of the fills well above the coarse chalk rubble in the west (Curwen 1934a, fig. 1: section V)	4410±35	−23.5	3.04	4399±24 T'=0.2; T' (5%)=3.8; ν=1	3100–2910	
OxA-14064	Brighton Museum R3688/139/M (2)	Replicate of GrA-26973	From the same context as GrA-26973	4389±32	−23.1				
South-west tangential ditch									
OxA-16284	22547 II (5)	Horse. Distal metapodial fragment	SW tangential ditch, context 5. Silt loam covering chalk rubble. (Russell and Rudling 1996, 40–5; section not published)	2929±30	−21.7			1270–1010	
GrA-32438	222547 III (81)	Cattle-sized animal. 1 of several recently broken tibia fragments	SW tangential ditch, context 81. Silt loam covering chalk rubble (Russell and Rudling 1996, 40–5; section not published)	3355±35	−21.5			1750 –1520	

on disarticulated cattle femurs and can be treated only as *termini post quos* for their contexts. They furthermore have large standard deviations which make their calibrated ranges span most of the fourth millennium cal BC. These samples were processed by Teledyne Isotopes in 1981 using GPC of carbon dioxide. The pretreatment method for these samples is not entirely clear, although it was probably the acid-based protocol described by Berger *et al.* (1964), as modified by Haynes (1967, 163), probably with an additional stage using cold sodium hydroxide. In either case, the laboratory dated the protein fraction of the bone (see Chapter 2.6).

Objectives of the dating programme

Apart from overall points of sequence and duration, specific questions which arose at the start of the dating project included whether the contrast in plan and scale between the inner and outer pairs of circuits indicates diachronic construction, and the date of the south-west tangential ditch excavated in 1991.

Sampling strategy and simulation

Sampling of the assemblages recovered in the 1920s and 1930s was restricted by the uneven retention of animal bone. This led to the dating of less than optimal bone samples and to considerable reliance on charcoal and carbonised residues on pottery. A roe deer skeleton from Ditch IV (Curwen 1934a, 102, pl. XV) could not be found, although it was at one time reconstructed and displayed. Excavation by spits in 1929 and 1932–3 (Fig. 5.3) meant that, as in Keiller's excavations at Windmill Hill, finds could be attributed only approximately to the layers from which they had come. There were very few potential samples from the ditch sections excavated stratigraphically in 1935.

Based on an assessment of the available samples, a series of simulations were constructed to determine how many samples would be required from different parts of the enclosure circuits, in order to refine the chronology of the monument (e.g. Fig. 5.4). In addition to statistical criteria, consideration was given to obtaining sequences of samples from more than one segment in each circuit, and ideally samples from different parts of each circuit, in order to build an archaeologically representative sampling strategy.

Results and calibration

Thirty-eight dates were obtained in the course of this project. Details of all the radiocarbon measurements from Whitehawk are provided in Table 5.2.

Analysis and interpretation

The main model for the chronology of Whitehawk is shown in Figs 5.5–9. The overall structure of the model is shown

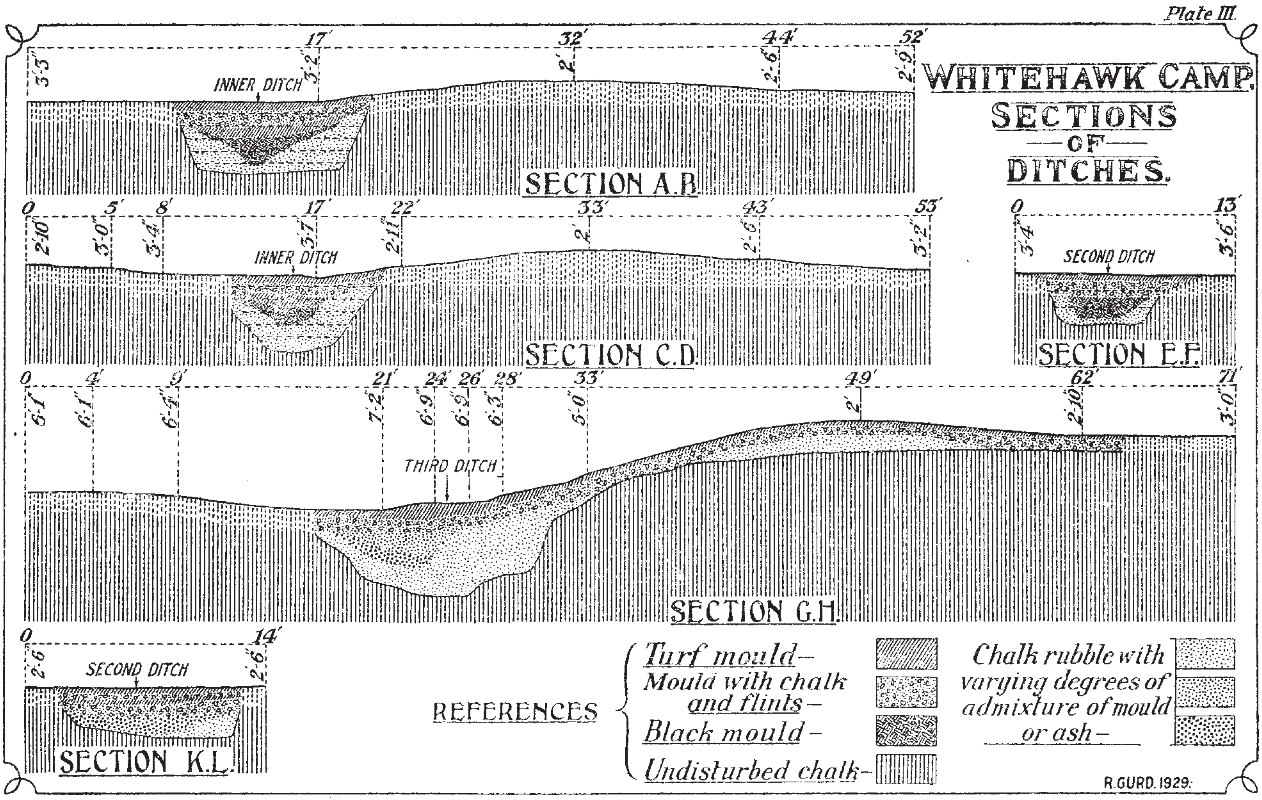


Fig. 5.3. Whitehawk. Sections through Ditches I, II and III from Ross Williamson's 1929 excavations, the upper two showing the relation of 9-inch (0.23 m) spits to the stratigraphy. After Ross Williamson (1930, pl. III).

in Fig. 5.5. As with other sites, this is constructed on the premise that the primary use of the circuits from their initial construction to the end of the accumulation of chalk rubble and the beginning of secondary silting forms a basically uninterrupted and continuous phase of activity.

Ditch I. Samples were available from two adjacent segments excavated by Ross Williamson in the north of the circuit in 1929 and from a section cut across the east of the circuit by Curwen in 1935. The first of Ross Williamson's segments was excavated in three sections (CI, CII, CIII), the second in a single cutting (CVI; Ross Williamson 1930, pl. II). The two published sections are of CII (Fig. 5.3: C–D) and the interface of CI and CIII (Fig. 5.3: A–B). They show that only spit 6, the lowest one, and, in CII in the east of the segment, spit 5, consisted solely of chalk rubble, the others all including parts of subsequent layers, predominantly so from spit 3 upwards. From spit 6 in CII came an antler tine tip damaged in such a way as to suggest that it had formed part of a pick. If so, it should be close in age to the original digging of the ditch. Replicate measurements on this sample are statistically consistent (T'=1.6; T'(5%)=3.8; ν=1) and in good agreement with its interpretation as an implement used in construction (Fig. 5.6: *antler R3162.169/N*).

All the remaining samples from this area consist of internal carbonised residue from sherds. Those from spit 5 in CI and spit 4 in CII and CIII could have come either from chalk rubble or from the 'black mould'; those from spit 3 in CVI could have come from chalk rubble, the 'black mould' or the overlying soil layer. In all cases the 'black mould' is the most likely provenance because 'it was in this black mould . . . that practically all the finds occurred. Little else than a few roughly worked flints were found in the chalk' (Ross Williamson 1930, 61). The samples from spits 5, 4 and 3 may thus all have come from the same deposit. If the spits are modelled as if they were stratigraphically successive the model has poor overall agreement ($A_{overall}$=43.1%), although if no chronological sequence is inferred and they are modelled as if from a single phase, all but *OxA-14157* show good agreement (Fig. 5.6). This option is therefore preferred.

There is no ambiguity as to the context of *GrA-32367*, the sample for which came from layer 2, the 'black mould' in Curwen's section on site A in 1935. On this basis the construction date of ditch I is estimated as *3635–3560 cal BC* (*95% probability*; Fig. 5.6: *dig Whitehawk I*), probably *3635–3580 cal BC* (*68% probability*).

Ditch II provided a sequence of two samples from the section cut by Curwen in the east of the circuit on site B in 1935. Residue from a single sherd from what is likely to have been the lowest layer is dated by *OxA-14031* (Fig. 5.7), and a pair of replicate samples from an articulating bone group came from layer 3, 'a light grey triangle of occupation debris, containing a large quantity of animal bones, some worked flints, but very little pottery', overlying chalk rubble fill (Curwen 1936, 71, fig. E). These last two produced statistically consistent radiocarbon measurements (T'=0.7; T'(5%)=3.8; ν=1; Fig. 5.7: *R4100/143/W*).

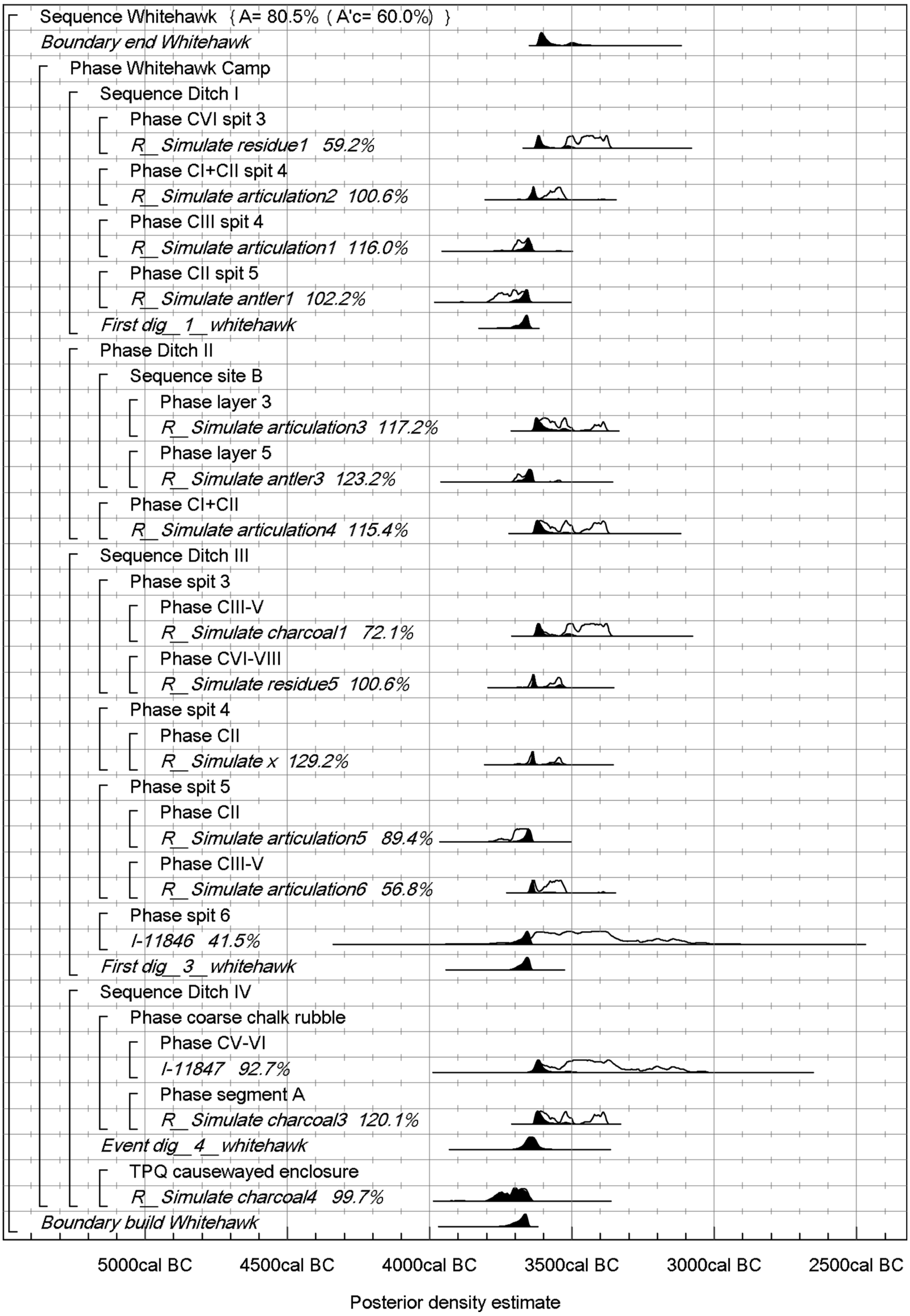


Fig. 5.4. Whitehawk. Probability distributions of simulated dates. Each distribution represents the relative probability that an event occurred at a particular time. For each of the dates two distributions have been plotted, one in outline which is the result produced by the scientific evidence alone, and a solid one which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution 'build Whitehawk' is the estimated date when the first element of the complex was constructed. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

The remaining samples are from Ross Williamson's 1929 excavations in the north of the circuit and are hence recorded by spit. As in Ditch I, a concentration of finds in the 'black mould' (Ross Williamson 1930, 61) makes it probable that this deposit was the context of samples from spits which at least partly coincided with it. This applies to two articulating samples from spit 3 in CII (*OxA-16368, -16285*) and to an articulating sample from spit 2 in CI in

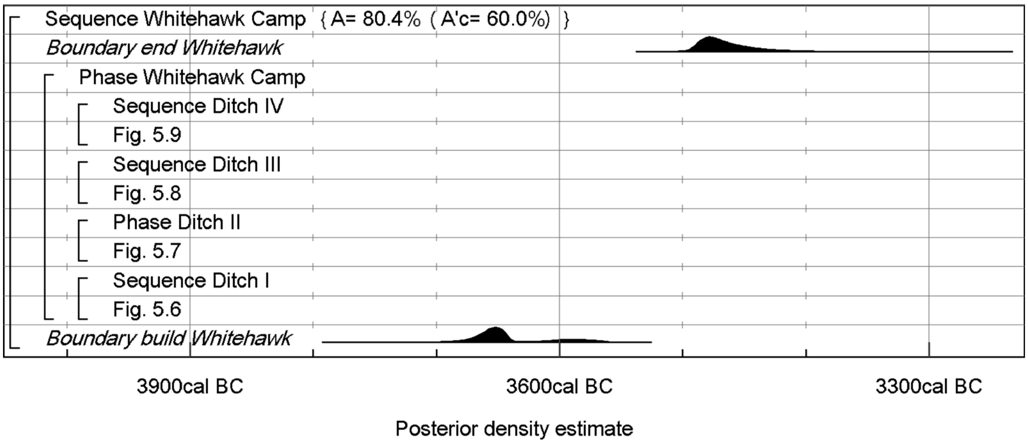


Fig. 5.5. Whitehawk. Overall structure of the chronological model. The format is identical to that for Fig. 5.4. The component sections of this model are shown in detail in Figs 5.6–9. The large square brackets down the left-hand side of Figs 5.5–9, along with the OxCal keywords, define the overall model exactly.

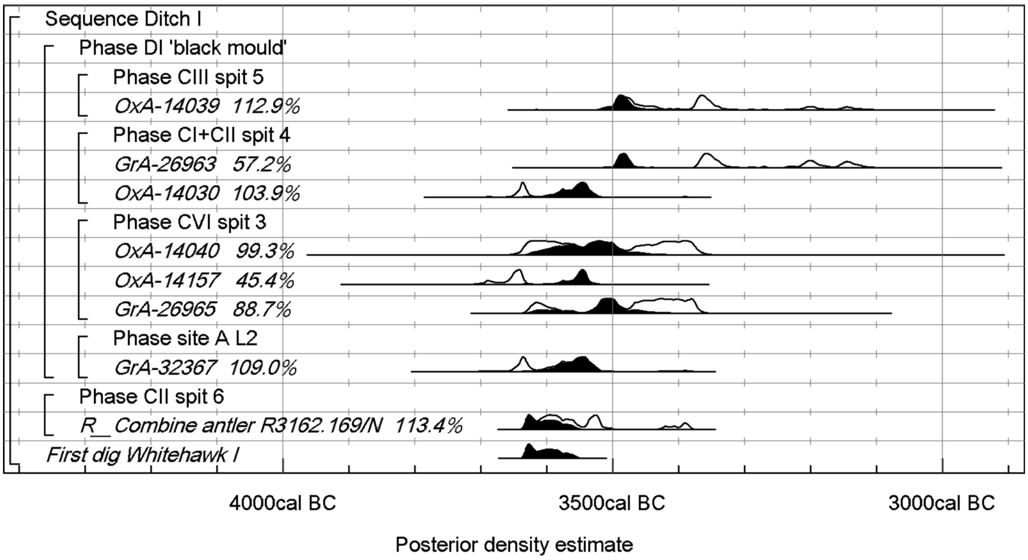


Fig. 5.6. Whitehawk. Probability distributions of dates from ditch I. The format is identical to that for Fig. 5.4. The overall structure of this model is shown in Fig. 5.5, and its other components in Figs 5.7–9.

the same segment (*GrA-32362*). The exception is a pair of statistically consistent replicate measurements on a fitting sample (*R3162/AA*; T'=0.0; T'(5%)=3.8; ν=1) from spit 4 in CIV in the next segment, where there is no record of any 'black mould' (Ross Williamson 1930, 94–5, pl. III: section K–L).

The context of Skeleton III, an articulated adult male found 3 m inside the inner lip of the ditch here, is ambiguous. The skeleton was 'lying on the surface of the undisturbed chalk and covered only by a foot of topsoil' (Curwen 1936, 70). Its survival strongly suggests that it was protected, at least up to the time of ploughing in the nineteenth century, by burial either in a ploughed-out grave or beneath a vanished bank, and the samples were submitted on the premise that the skeleton was likely to have underlain a bank and hence to have pre-dated the digging of the ditch. Since, however, the only detectable bank associated with Ditch II is an *external* one, and there would have been little space between Ditches I and II for an *internal* one (Fig. 5.2), it now seems more probable that the skeleton was buried in a grave and cannot be related to the construction of the earthwork. Two replicate measurements on it are not statistically consistent (Table 5.2: GrA-26966, OxA-14061; T'=6.2; T'(5%)=3.8; ν=1), but are both later than OxA-14031 from the lowest layer in the ditch; their mean is employed here because there is no criterion by which to judge which may be closer to the radiocarbon age of this sample (Fig. 5.7: *skeleton III*).

OxA-14031 is the only available measurement which is definitely from below the 'black mould' in ditch II. We estimate ditch II to have been dug in *3675–3630 cal BC* (*72% probability*; Fig. 5.7: *dig Whitehawk II*) or *3600–3545 cal BC* (*23% probability*), probably *3665–3635 cal BC* (*67% probability*) or *3580–3570 cal BC* (1*% probability*). It should be noted that this estimate is earlier than the result from the antler tine (Fig. 5.6: *antler R3162.169/N*) from the

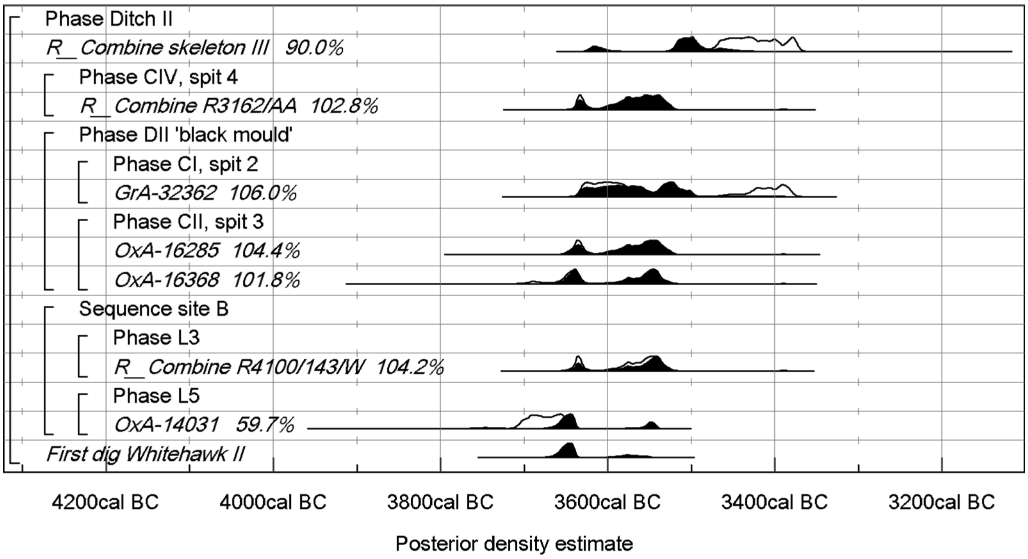


Fig. 5.7. Whitehawk. Probability distributions of dates from ditch II. The format is identical to that for Fig. 5.4. The overall structure of this model is shown in Fig. 5.5, and its other components in Figs 5.6 and 5.8–9.

base of ditch I (T'=16.3; T'(5%)=16.8; ν=1). Thus, either the sherd was redeposited or ditch II is earlier than ditch I.

Ditch III was the biggest (Fig. 5.2) and has furnished the largest suite of samples from the site, one from Ross Williamson's 1929 section in the north of the circuit and the remainder from Curwen's more extensive 1932–3 excavation of three adjacent segments (CII, CIII–CV and CVI–CVIII) in the south. In both areas there was an 'occupation layer' in the ditch (shown in heavy stipple in Fig. 5.3), of chalk rubble mingled with charcoal, artefacts and animal bone, generally some 0.25 m thick, deposited after first coarse and then medium chalk rubble had silted into the ditch, which 'must therefore date within a very few years of the digging of the ditch. The greater part of the pottery and other relics came from this layer' (Curwen 1934a, 107). The difficulty of provenancing samples recorded by spit is compounded by the probability that an original, shallower ditch had been recut, at least in the south (Curwen 1934a, 107, pl. XIV), and perhaps in the east and west (Curwen 1936, figs B, D).

The only samples definitely from contexts underlying the 'occupation layer' consist of a disarticulated cattle femur from 'coarse chalk rubble' in Curwen's CVII (Fig. 5.8: *I-11846*) and an articulating sample from among at least 11 bones from a single goat from spit 6 in Ross Williamson's CI, on which two replicate measurements have been made (Fig. 5.8: *Brighton Museum/C*; T'=0.0; T'(5%)=3.8; ν=1). The femur was probably not redeposited because the measurement from it is statistically consistent with those on the articulating sample (T'=0.2; T'(5%)=3.8; ν=1). The goat remains represent the immediate aftermath of butchery and consumption and their position 0.45–0.70 m above the ditch base indicates that they were deposited after a brief and rapid accumulation of rubble.

Some samples are specifically recorded as coming from the 'occupation layer', in the report, in their labelling, or in both. They are Skeletons I and IIa, articulated human females from CII and CV (Curwen 1934a, pls XIV, XVII; Fig. 5.8: *GrA-26971*, *skeleton IIa*) and one residue and two charcoal samples from a hearth in CIV (Fig. 5.6: *GrA-26969, OxA-14145,* GrA-27328). The two articulated skeletons must have been recently dead when deposited and close in age to the layer. The two measurements from Skeleton IIa are statistically consistent (T'=0.0; T'(5%)=3.8; ν=1). The surviving burnt material from the hearth was mainly bone, and among the charcoal only samples identified as possibly rather than definitely oak sapwood were available. One of them, GrA-27328, is older than the two skeletons and than samples from the underlying chalk rubble and is excluded from the model. The other charcoal date, *OxA-14145*, is statistically consistent with the dates for both skeletons (T'=1.8; T'(5%)=6.0; ν=2) and is taken as contemporary with its context. The residue date, *GrA-26969*, is not statistically consistent with these (T'=15.4; T'(5%)=7.8; ν=3) and is the most recent of all the dates from or probably from the 'occupation layer'. It is nonetheless in good agreement with the model.

In addition, Curwen's sections (1934a, fig. 2) indicate that samples from the following spits *could* have come from the 'occupation layer': CV spit 5, adjacent to skeleton IIa (Fig. 5.8: *OxA-14204, GrA-27325, residue R3688/73/E*) and CVII spit 6 (Fig. 5.8: *GrA-27327, OxA-14144*). Given that finds were concentrated in the 'occupation layer', it is probable that this was indeed the context of the samples, especially in the case of charcoal, which gave the deposit its characteristic dark colour. None of the five is statistically inconsistent with the dates for the two skeletons (T'=7.4; T'(5%)=12.6; ν=6), which indicates that these samples could indeed have come from the 'occupation layer'. The two measurements on the body sherd of Neolithic Bowl (GrA-26976 and OxA-14041) are also statistically consistent (T'=0.6; T'(5%)=3.8; ν=1).

CII presents a further difficulty because disturbance caused by the laying of the gas pipe mentioned above makes

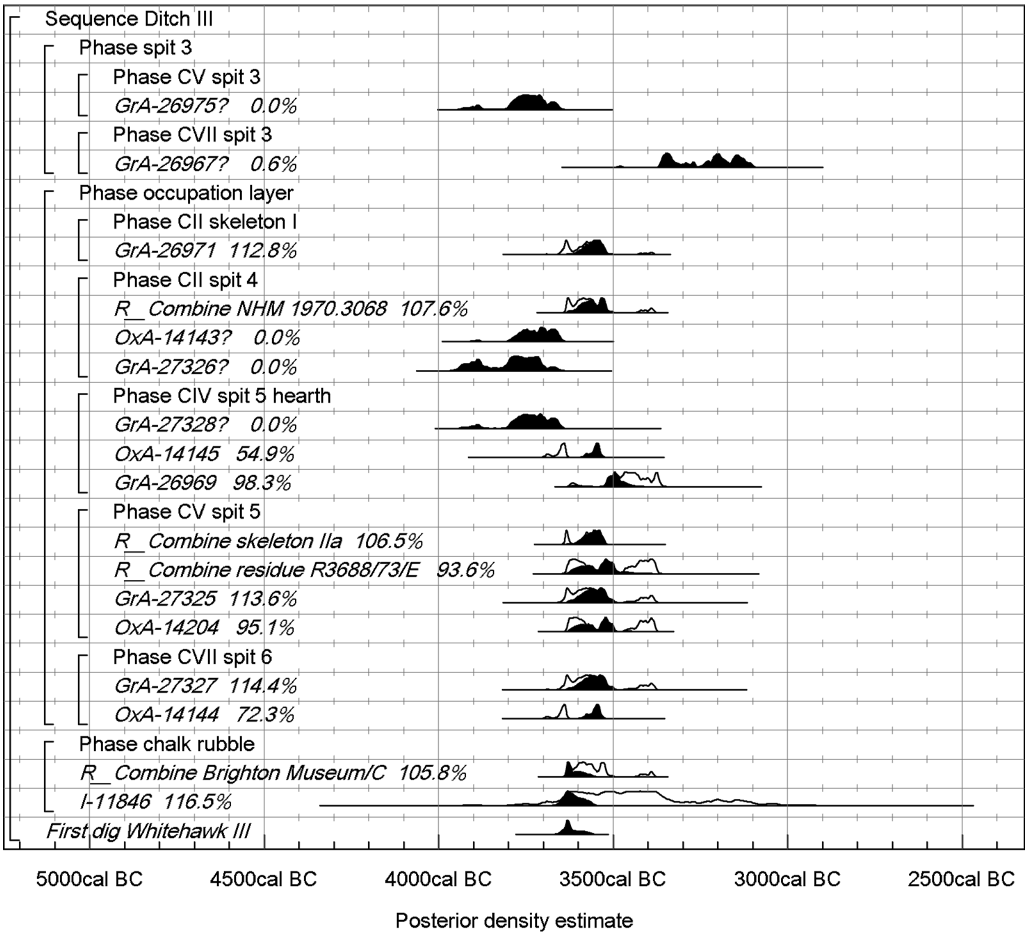


Fig. 5.8. Whitehawk. Probability distributions of dates from ditch III. The format is identical to that for Fig. 5.4. The overall structure of this model is shown in Fig. 5.5, and its other components in Figs 5.6–7 and 5.9.

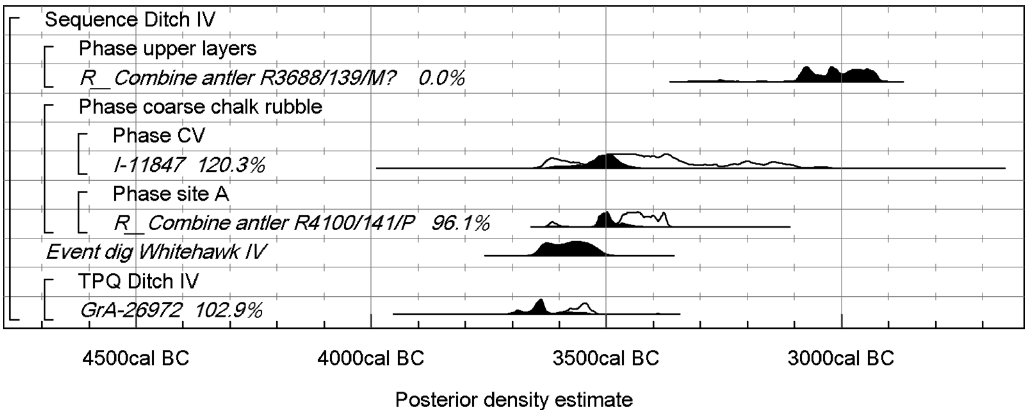


Fig. 5.9. Whitehawk. Probability distributions of dates from ditch IV. The format is identical to that for Fig. 5.4. The overall structure of this model is shown in Fig. 5.5, and its other components in Figs 5.6–8.

it difficult to be sure from what level spits were measured. If they were measured from the top of the disturbed ground (Curwen 1934a, fig. 2: section I), then CII spit 4 and its contained samples (Fig. 5.8: OxA-14143, GrA-27326, *NHM 1970.3068*) would have been above the 'occupation layer' and skeleton I. If spits were measured from a lower level, the samples may have fallen within the occupation layer. Replicate measurements on an articulating sample (Fig. 5.8: *NHM 1970.3068*) are statistically consistent (T'=1.3; T'(5%)=3.8; ν=1), and consistent with the dates for the two skeletons (T'=0.7; T'(5%)=6.0; ν=2), and suggest that this sample too could have come from the 'occupation layer'. The two charcoal samples from the same spit (Fig. 5.8: OxA-14143, GrA-27326) are both older than skeleton I, which must have come either from the same layer as them or from an underlying layer. They are therefore excluded from the model as being probably redeposited.

The remaining two samples, internal carbonised residues

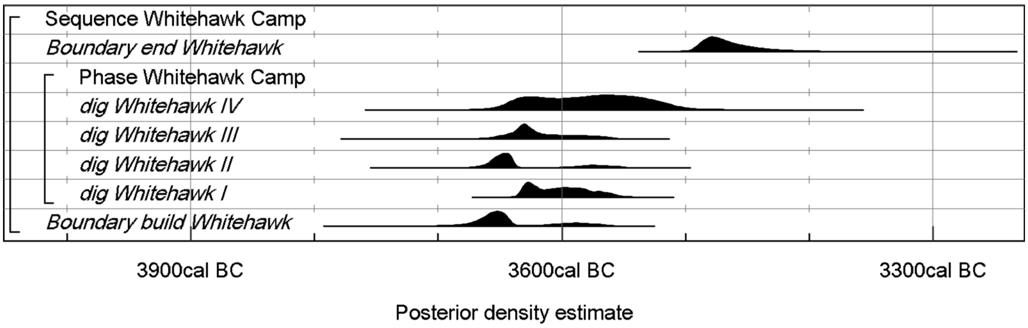


Fig. 5.10. Whitehawk. Probability distributions for key parameters, derived from the model defined in Figs 5.5–9.

on sherds from CV spit 3 (Fig. 5.8: GrA-26975) and CVII spit 3 (Fig. 5.8: GrA-26967), were well above the 'occupation layer' in secondary or even tertiary fills. The first is older than most of the samples from the underlying 'occupation layer' and is excluded from the model as redeposited. The second has poor agreement (A=14.8%) if included as part of the main phase of Neolithic use at Whitehawk. It has therefore been excluded from the model but may provide an indication of later use of the site.

On this basis, the model suggests that ditch III was dug in *3660–3560 cal BC* (*95% probability*; Fig. 5.8: *dig Whitehawk III*), probably in *3650–3600 cal BC* (*68% probability*). This almost certainly applies to the recut rather than the original ditch.

Ditch IV was, as Curwen points out (1934a, 102), almost certainly recut, on the evidence of the plan (Curwen 1934a, pl. XIII; 1936, figs B, D), as with Ditch III, and, in this case, also on the evidence of the irregular profiles of the sections excavated in 1932–3 (Curwen 1934a, fig. 1). There was no distinctive horizon comparable to the 'black mould' of Ditch I or the 'occupation layer' of Ditch III. There are one existing date, two new samples from CV in Curwen's excavations in the south of the circuit (Fig. 5.9: *GrA-26972, I-11847,* antler R3688/139/M), and one new sample from his section across the east of the circuit on site A (Fig. 5.9: *antler R4100/141/P*).

In CV, hole 5 was a pit cut into a causeway which was lower than the surface of the chalk elsewhere and which had been truncated by the recutting of Ditch IV. 'The south wall of the hole was partly broken away', suggesting that it may have been truncated when the ditch was recut. At the base of hole 5 was the roe deer skeleton mentioned above, partly dismembered and 'huddled upon its back' (Curwen 1934a, 102, pls XII, XV; fig. 1: section IV). The skeleton, which would have been buried soon after dismemberment, could not be found in 2004. It was, however, accompanied by a substantial but weathered cattle tibia fragment. This disarticulated bone provides a *terminus post quem* for the roe deer and, if the lowered south side of the pit was not a product of subsequent weathering, for the recutting of the ditch (Fig. 5.9: *GrA-26972*).

A disarticulated cattle femur from the coarse chalk rubble on the base of the recut in the same section (Fig. 5.9: *I-11847*) post-dates the tibia, as do two statistically consistent replicate measurements on an antler tine tip from the same horizon on site A (Fig. 5.9: *antler R4100/141/P*). If the tine tip formed part of a pick used to dig the ditch it should be close in age to that event. A more substantial pick fragment from spit 7 in CV was originally submitted in the belief that it came from near the base of the ditch but, given the lateness of its two statistically consistent replicate measurements (Fig. 5.9: antler R3688/139/M; T'=0.2; T'(5%)=3.8; ν=1), it probably came from the deeper side of the cutting, where spit 7 would have been in the middle of the fills, well above the coarse primary chalk rubble (Curwen 1934a, fig. 1: section V).

On this basis, the construction date for Ditch IV is estimated as *3650–3505 cal BC* (*95% probability*; Fig. 5.9: *dig Whitehawk IV*), probably *3635–3610 cal BC* (*18% probability*) or *3600–3530 cal BC* (*50% probability*). As with Ditch III, this almost certainly applies to the recut rather than the original ditch.

Two samples were dated from *the south-west tangential ditch*, to test the hypothesis, outlined above, that it might be of post-Neolithic date. Lack of finds from the lowest fills and lack of optimal samples throughout necessitated the dating of two weathered, disarticulated bone samples from the relatively finds-rich silt loams in which a flint industry of Bronze Age character was concentrated. Both thus provide *termini post quos* for these deposits, which may themselves have accumulated over some time. A horse metapodial from context 5 is dated to 1270–1010 cal BC (95% confidence; Table 5.2: OxA-16284) and a cattle-sized tibia fragment from context 81 is dated to 1750–1520 cal BC (95% confidence; Table 5.2: GrA-32438).

The two measurements are statistically inconsistent (T'=63.7; T'(5%)=3.8; ν=1); both, however, fall within the second millennium cal BC. The deposits from which they came overlay dense chalk and flint rubble in a chalky loam weathered from the sides of the ditch. Ken Thomas (1996, 52) considered that 'the ditch filled in quite rapidly, or under fairly constant environmental conditions, for some two-thirds of its depth'. Once this had occurred, the silts which were the context of the samples began to form. If the ditch was cut in the earlier fourth millennium cal BC, the rubble fills would thus have taken two millennia to accumulate. This is difficult to imagine, especially as the demonstrably Neolithic enclosure ditches at Whitehawk had almost completely silted before any Beaker or Bronze Age material entered them. This includes Ditch IV, 40 m

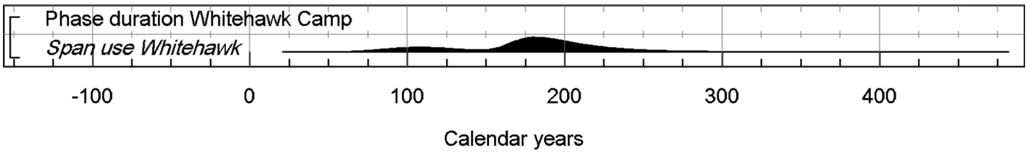


Fig. 5.11. Whitehawk. Probability distributions of the number of years during which the enclosure was in primary use, derived from the model defined in Figs 5.5−9.

to the east, of which the south-west tangential ditch was seen as a continuation (Curwen 1934a, 104, fig. 1). The measurements indicate that the south-west tangential ditch was dug in or after the second millennium cal BC.

Implications for the site

This dating programme represents a significant advance in our understanding of the chronology of Whitehawk, gleaned almost entirely from the inter-war archive. It must be admitted, however, that our chronology is less than entirely satisfactory. The only dateable material from the primary chalk rubble in Ditch II is a residue sample from a single sherd, which could have been redeposited. The date of Ditch IV depends on non-optimal samples, and those for both Ditches III and IV may relate to recuts rather than to the original circuits. Many elements of the complex remain undated.

Within these limitations, it appears that the four circuits were built between the middle of the 37th century and the end of the 36th century cal BC (Fig. 5.10). The major period of construction may have been confined to the second half of the 37th century cal BC. Overall, Whitehawk was in primary use for *75–260 years* (*95% probability*; Fig. 5.11: *use Whitehawk*), probably for *100–115 years* (*4% probability*) or *155–230 years* (*64% probability*). Although it is tempting to infer an order for the construction of the circuits at Whitehawk from this model (Fig. 5.10), we believe that this could well be misleading given the current restrictions on sample availability

The south-west tangential ditch is a later prehistoric accretion, perhaps a cross-ridge dyke, as Oswald *et al.* (2001, 142–3) concluded. The exceptional grassland molluscan fauna which obtained throughout its fills is no reflection of the fourth millennium cal BC landscape. The status of the north-east tangential ditch, which, unlike this one, is clearly causewayed, remains to be determined.

5.2 Offham Hill, Hamsey, Lewes, East Sussex, TQ 3988 1175

Location and topography

The enclosure lies at 110 m OD, just below the highest point of a spur of Upper Chalk projecting from the north face of the South Downs, above the Ouse valley (Fig. 5.1; Drewett 1977, fig. 1; 1994, fig. 14; Oswald *et al.* 2001, fig. 5.24: A).

Offham Hill consists of two circuits, the eastern parts of which had been removed by a chalk quarry by the time of investigation (Fig. 5.12). The original area may have been in the region of 1 ha. Ditch and bank segments seemed broadly co-terminous (Drewett 1977, fig. 2; Oswald *et al.* 2001, fig. 4.8). Two round barrows were subsequently built higher up the hill, to the south of the enclosure.

History of investigation

The already known and scheduled enclosure was recognised as possibly causewayed following scrub clearance and ploughing in the early 1970s (Holden 1973). Excavation by the Sussex Archaeological Field Unit, directed by Peter Drewett, took place in 1976, funded by the Department of the Environment in anticipation of further plough damage (Drewett 1977). Approximately half of the surviving area was stripped and excavated. Possibly prehistoric features in the interior were confined to two undated postholes. Both ditches were shallow, surviving to at most 0.80 m, and had silted naturally and symmetrically, suggesting that berms had separated them from the banks (Fig. 5.13). Shallowness and scrub growth meant that the fills were often root- and animal-disturbed, Iron Age and Romano-British sherds being present in all but the lowest layer (Drewett 1977, 219–21).

Finds were generally scant and abraded, although less so in the outer ditch than the inner. Despite the excavation of some 30 m of the inner ditch and 65 m of the outer, there were only 171 sherds of Bowl pottery, six fragments of human bone in addition to an articulated burial, and just over 100 identifiable animal bones; charcoal was scarce and in poor condition; and flotation yielded no seeds or grain. The only substantially represented category was struck flint, of which there are 6830 pieces. High frequencies of cortical flakes combine with low frequencies of cores (0.9%) and retouched pieces (0.3%) to suggest an 'industrial' facies, with cores prepared on the site and removed elsewhere (James 1977), an emphasis reinforced by eight nests of large flakes in both ditches (Drewett 1977, 208, pl. 17). The only instances of obviously deliberate deposition other than the nests of flint flakes were in the base of the outer ditch. A pit cut into the base of segment 4 contained the unaccompanied, crouched, articulated burial of a young male (Drewett 1977, 209, fig. 5, pl. 17; T. O'Connor 1977a). Another, cut into the base of segment 2, contained 17 freshly broken, unabraded sherds from a single pot, a leaf-shaped arrowhead, flint flakes, and bones and/or teeth of red deer, roe deer, beaver, cattle and pig (Drewett 1977, 209; T. O'Connor 1977b, 231). Small quantities of Beaker and Early Bronze Age wares were present in the upper levels.

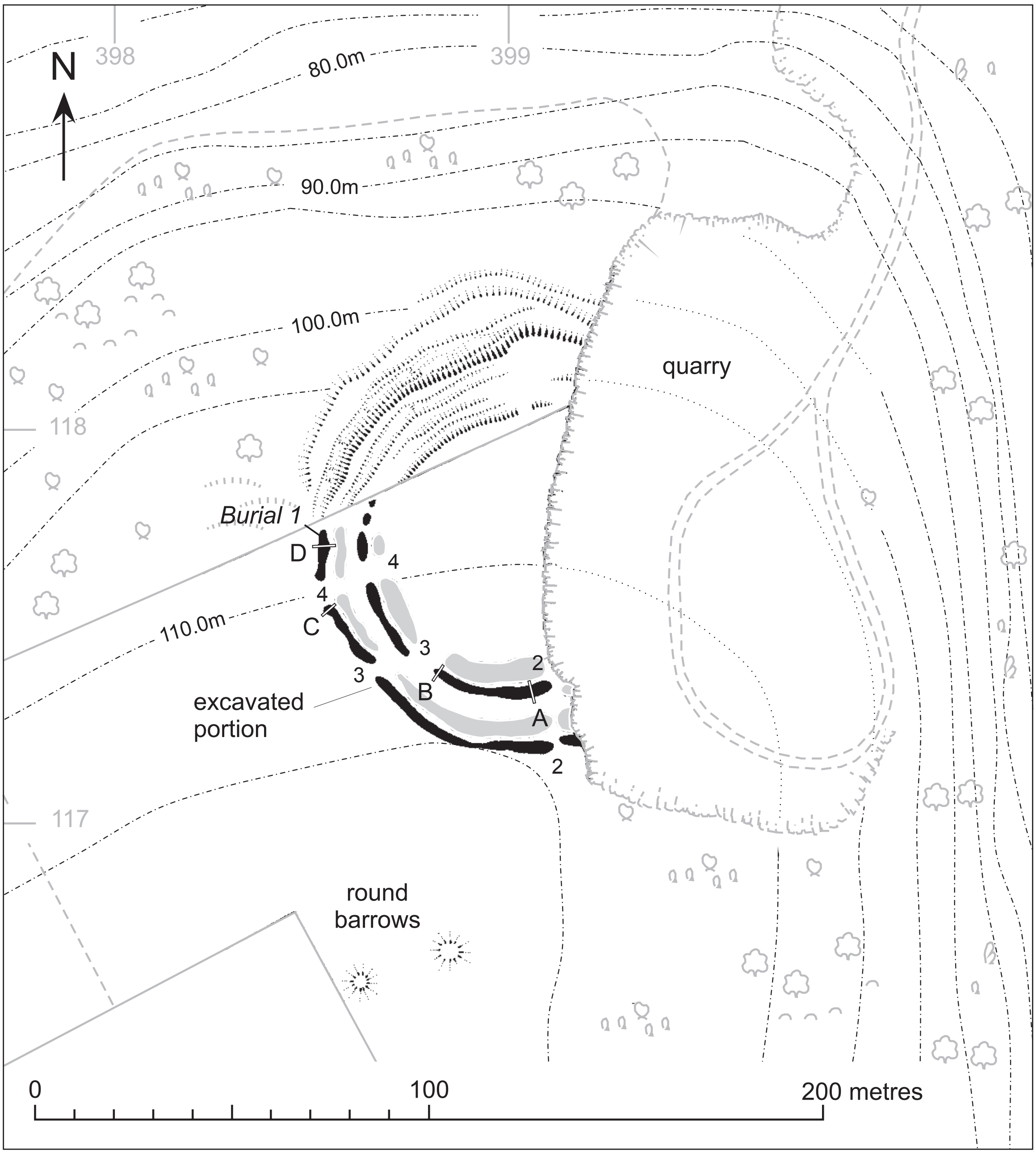


Fig. 5.12. Offham Hill. Plan showing location of excavations. After Oswald et al. *(2001, fig. 4.8).*

The Mollusca, as well as reflecting the contemporary environment, indicated that the two ditches had been cut at different times (K. Thomas 1977). In the inner ditch, a woodland fauna in the lowest layer gave way in the layer above to one showing a decline in shade-preferring species and an increase in those associated with clearance and, to a very limited extent, open country. The outer ditch contrasted with this, in that a predominantly woodland fauna persisted through both the lowest and penultimate layers, with rather less indication of clearance in the latter. A possible buried soil under the reduced bank of the outer ditch, however, yielded a fauna similar to that of penultimate layer in the inner ditch. Thomas' interpretation was that the enclosure was built in a clearing, surrounded by woodland which precluded the migration of open-country species; the woodland fauna of the lowest layer of the inner ditch was a pre-clearance one, derived from the surrounding topsoil; the fauna of the penultimate layer of the inner ditch and of the soil beneath the outer bank was of the clearance phase; and the outer ditch was built after the inner, closer to the woodland edge and possibly after woodland had begun to regenerate (K. Thomas 1977, 239).

Other interpretations are possible, and post-Neolithic shells may have been present, since the soil beneath the bank was covered by only 0.15 m of bank material and penetrated by roots (K. Thomas 1977, 234–5) and post-Neolithic pottery was present in the penultimate layers of both ditches (Drewett 1977, 219–21).

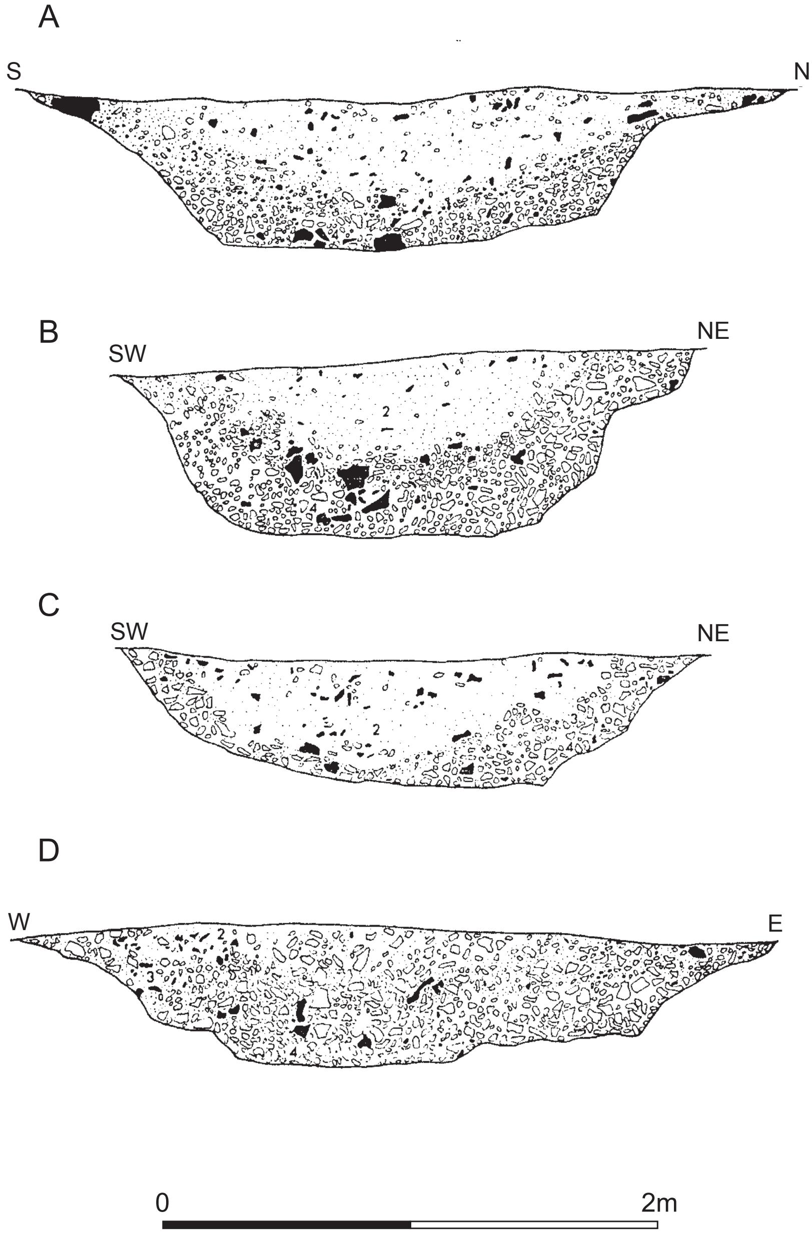


Fig. 5.13. Offham Hill. Sections of segment 2 of the inner ditch (A, B) and segments 2 (C) and 4 (D) of the outer. The amount of chalk rubble in segment 4 of the outer ditch is atypical of the circuit as a whole. The locations of the sections are shown on Fig. 5.12. After Drewett (1977, fig. 7).

Previous dating

In addition to the sequence inferred from the molluscan evidence, two dates (Table 5.3: BM-1414–15) were obtained soon after the excavation from bulk oak charcoal samples stratified one above the other in the lowest and penultimate layers of segment 2 of the inner ditch (Drewett 1977, 239; Drewett *et al.* 1988, 35). While their ages are in agreement with their stratigraphic relationship, they can be regarded only as *termini post quos* for their contexts.

Objectives of the dating programme

The main aim was to establish the construction dates of both circuits and hence to define their sequence. The dearth of finds was such that the only suitable sample was from the articulated burial in the base of the outer ditch (Fig. 5.14: *burial 1*).

Full details of the radiocarbon measurements from Offham Hill are provided in Table 5.3.

Analysis and interpretation

In the inner ditch both samples provide *termini post quos* for their contexts. *BM-1415* provides a *terminus post quem* for the accumulation of the rubble fills in the inner ditch, and eventually its total infilling of *3645–3490* (*73% probability*; Fig. 5.14) or *3470–3375* (*22% probability*), probably of *3640–3500* (*68% probability*). In the outer ditch, two statistically consistent measurements were obtained on Burial 1 (T'=2.5; T'(5%)=3.8; ν=1). The articulation of

Table 5.3. Radiocarbon dates from Offham Hill and Combe Hill, East Sussex. Posterior density estimates derive from the models defined in Figs 5.14 and 5.31.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**$\delta^{15}N$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Offham Hill inner ditch									
BM-1414	Sample 1	Oak charcoal	Inner ditch, segment 2, layer 4. 4 was the lowest layer, lying directly on the ditch base (Drewett 1977, 205)	4925±80	−23.6			3950–3530	*3945–3625* (*91%*) or *3580–3530* (*4%*)
BM-1415	Sample 2	Oak charcoal	Inner ditch, segment 2, layer 3. 3 was the second-lowest layer (Drewett 1977, 205)	4740±60	−23.5			3650–3360	*3645–3490* (*73%*) or *3470–3375* (*22%*)
Offham Hill outer ditch									
OxA-14177	Burial 1. Barbican House Museum, Lewes 77.23	Proximal end of L femur of 20–25 year-old male. Replicate of GrA-27322	Outer ditch, segment 4, bottom. Buried articulated in a pit cut into the base of the outer ditch (Drewett 1977, 209, figs 4–5, pl. 17)	4722±32	−20.5		4743±26 T'=2.5; T'(5%)=3.8; ν=1	3640–3370	*3635–3555* (*66%*) or *3540–3490* (*23%*) or *3435–3380* (*6%*)
GrA-27322	Burial 1. Barbican House Museum, Lewes 77.23	Replicate of OxA-14177	From the same context as OxA-14177	4685±45	−20.9	10.49			
Combe Hill inner ditch									
I-11613		Probably ash, hazel and hawthorn charcoal (these were the only taxa identified from the excavation, and so it is likely that the sample was composed of them)	Deposit described as 'hearth' which looks in section like a recut into sterile primary silts in west of circuit. 'Hearth' contained >900 sherds Ebbsfleet Ware, animal bone, struck flint, 2 sandstone rubbers. This is listed as from 'Ditch I layer 3' by Drewett and Bedwin (1981), from 'Primary silt (Ditch 2)' by Drewett, Rudling and Gardiner (1988, 35) and from 'Secondary silt (Ditch 2) by Drewett (1994, table 4). Musson's 1950 report and fig. 3 and p. 7 of Drewett 1994 make it clear that Musson's excavations were in the inner ditch and that the 'hearth' from which the charcoal came was secondary	4590±100				3640–3010	*3635–3555* (*6%*) or *3540–3020* (*89%*)

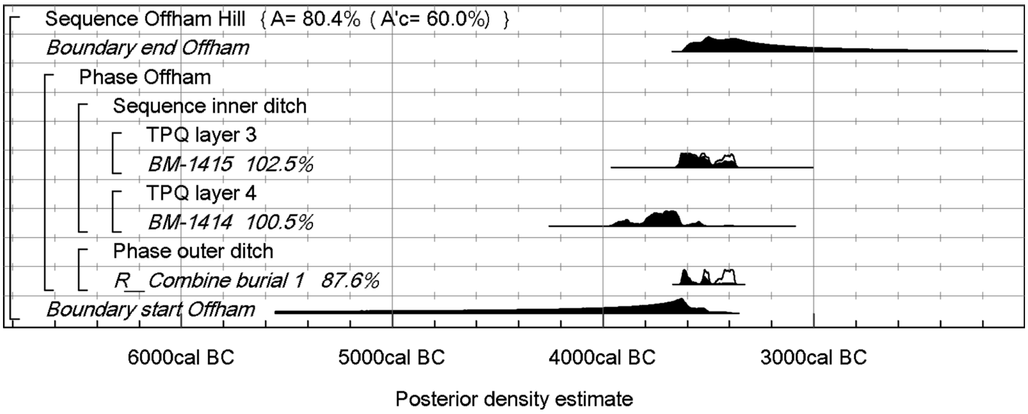


Fig. 5.14. Offham Hill. Probability distributions of dates. The format is the same as for Fig. 5.4. The square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

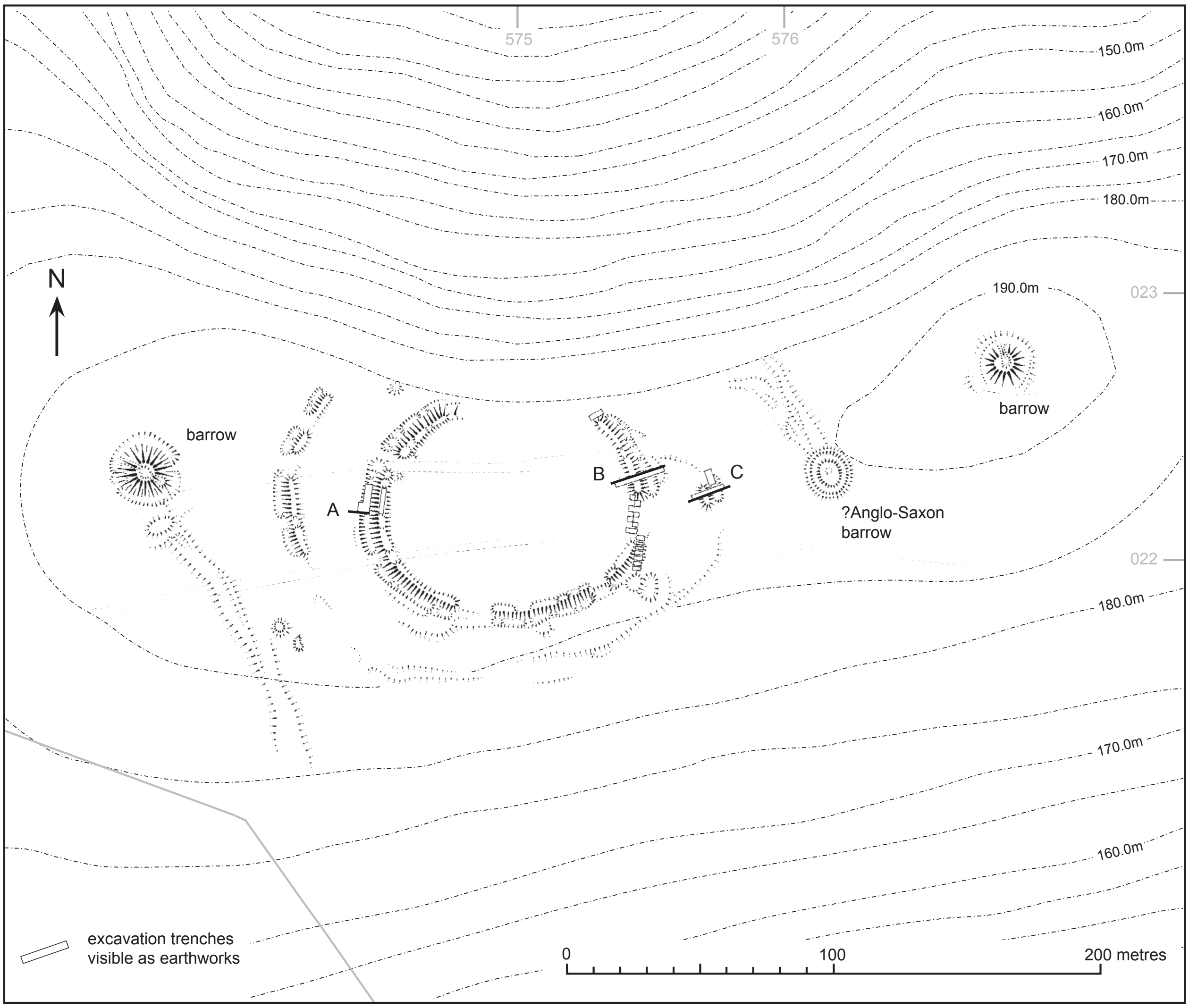


Fig. 5.15. Combe Hill. Plan showing cuttings. After Musson (1950, fig. 1), Drewett (1994, fig. 3) and Oswald et al. *(2001, fig. 8.5).*

this burial and the absence of any indication that it was cut into already accumulated fills mean that it provides a date for the construction of the circuit of *3635–3555 cal BC* (*66% probability*; Fig. 5.14: *burial 1*) or *3540–3490 cal BC* (*23% probability*) or *3435–3380 cal BC* (*6% probability*), probably *3630–3585 cal BC* (*56% probability*) or *3525–3505 cal BC* (*12% probability*).

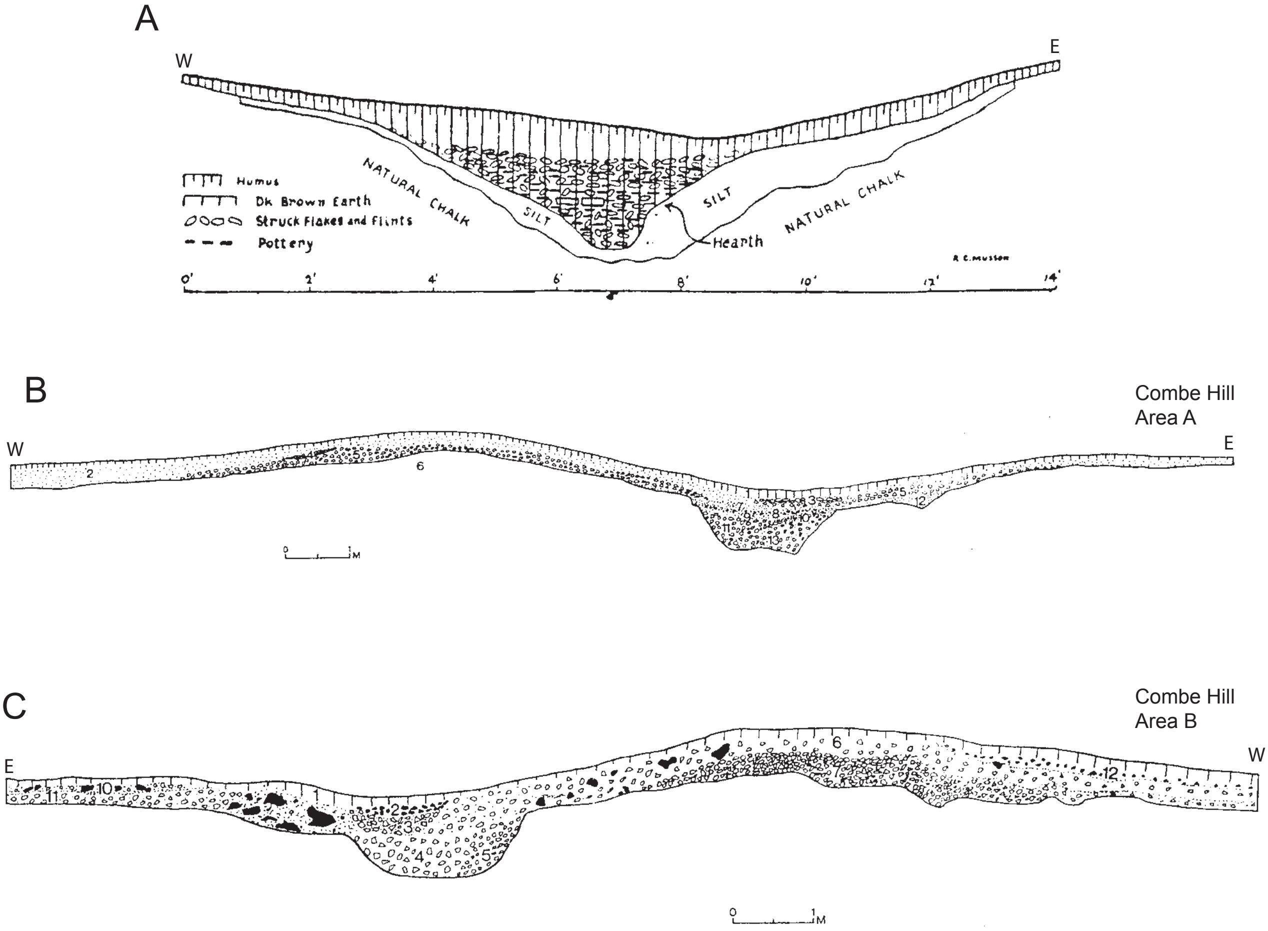


Fig. 5.16. Combe Hill. Sections through the inner ditch, excavated by Reginald Musson in 1949 (A), and through the inner ditch and bank (B) and the outer ditch and bank (C), both excavated by Veronica Seton Williams in 1962. Layers 2 and 3 in the outer ditch are the fills of a Romano-British feature (Drewett 1994, 9). The locations of the sections are shown in Fig. 5.15. After Musson (1950, fig. 2) and Drewett (1994, figs 5, 7).

Implications for the site

Although the plan and the Mollusca suggest a multi-staged history, the results of excavation indicate that Offham saw a low level of deposition and perhaps of frequentation. Radiocarbon dating cannot resolve the sequence of the two circuits but suggests that the enclosure is likely to have been used in the middle centuries of the fourth millennium cal BC.

5.3 Combe Hill, Eastbourne, East Sussex, TQ 5750 02220

Location and topography

Combe Hill lies on Upper and Middle Chalk at 190 m OD, on an elongated hilltop at the edge of the north escarpment of the South Downs, with an abrupt drop to The Weald (Fig. 5.1; Oswald *et al.* 2001, figs 5.25–6; Drewett 1994, fig. 14). The earthworks consist of an almost complete inner circuit, broken only at the steep scarp to the north, and an outer circuit visible to the east and west but vestigial to the south, with possible cross-ridge dykes beyond it (Fig. 5.15; Oswald *et al.* 2001, fig. 8.5). This uneven survival may reflect deliberate demolition at some time in the past (Oswald *et al.* 2001, 39). The area enclosed by the outer circuit is in the region of 1.7 ha. Particularly wide causeways in the south and east of the inner circuit are suggestive of entrances. Round barrows were built to either side.

History of investigation

In the early twentieth century the enclosure was surveyed by Hadrian Allcroft who recognised it as 'almost beyond doubt of British construction and of very early construction to boot' (1908, 312). Curwen surveyed the site 20 years later, supplementing the visible earthworks by bosing, and concluded that it was a causewayed enclosure (1929a, 75, 95; 1929c). In 1949, Reginald Musson cut two adjacent trenches in the west of the inner circuit, one sectioning a segment butt and extending across a causeway into the next segment, the other extending across the same causeway a little to the east into the crests of two bank terminals (1950, fig. 1; Fig. 5.16). In the south ditch butt, up to

0.30 m of clean chalk silt was succeeded by a 'hearth', so called because it contained two slabs of tabular flint set side-by-side. There is, however, no mention of burning *in situ* and the abrupt sides of the feature suggest that it may have been a recut (Fig. 5.16). It contained hundreds of Ebbsfleet Ware sherds and flint flakes, a scraper, a leaf-shaped arrowhead, a quern fragment and a rubber fragment, both of sandstone, and only a small amount of animal bone. Charcoal, which occurred in small quantities at several levels, was identified as branch and sapwood of *Corylus, Crataegus* and *Fraxinus*, 'likely to be only firewood' (Maby 1950). Molluscs subsequently extracted from soil samples taken from the 'hearth' during the excavation indicate that the contemporary surroundings were shaded or recently cleared of woodland (K. Thomas 1994).

In 1962, Veronica Seton Williams conducted a training excavation, in the course of which 21 small trenches were opened in seven areas, principally in the east of the inner circuit, including a grid of six trenches in the apparent entrance (Drewett 1994, fig. 3). A single trench in the north of the circuit found no trace of the ditch where the hill was steepest. Both ditches were 1 m or less deep. There was nothing comparable with Musson's 'hearth', the inner and outer ditches (the latter sectioned only in one trench) having silted naturally (Fig. 5.16), and a recut in the outer ditch was of Romano-British date. Finds were scarce. Despite the excavation of some 15 m of the inner ditch and some 2 m of the outer, there was no Neolithic pottery at all, and only a few hundred pieces of struck flint, which were concentrated in the entrance area rather than in the ditch (Drewett 1994, 17). The only remarkable find was a group of three partly ground flint axeheads placed side-by-side in the middle fill of the inner ditch segment to the south of the entrance (Drewett 1994, 15, figs 11, 12). There is little mention of bone in Seton Williams' notebooks, and only eight animal bone small finds in her finds book. Given that the ditch fills consisted overwhelmingly of chalk rubble, in which bone is excellently preserved, the scarcity seems to have been an original one. Fine and rusticated Beaker pottery from the upper ditch fills may relate to the round barrows to either side of the monument.

Previous dating

A bulk charcoal sample from Musson's 'hearth' was dated to 3640–3010 cal BC (95% confidence; Table 5.3: I-11613). Since all the charcoal from this context was identified as short-lived, the deposit probably lies somewhere within the broad span of the date, which provides a *terminus ante quem* for the construction of the inner circuit. This is compatible with the general dating of Peterborough Ware (Gibson and Kinnes 1997).

Sampling strategy

Only a handful of disarticulated animal bone and some charcoal flecks could be found in the collections and no suitable samples could be located.

Implications for the site

As with Offham Hill, although the plan of Combe Hill suggests a multi-staged history, the results of excavation so far indicate that it saw a low level of deposition and perhaps of frequentation.

5.4 The Trundle, Singleton, Chichester, West Sussex, SU 8774 1107

Location and topography

The Trundle lies on the Upper Chalk of St Roche's Hill, a well defined, isolated summit visible from all directions (Drewett 1994, fig. 14), although the circuits are slightly 'tilted' northwards, towards the main range of the South Downs (Fig. 5.1; Oswald *et al*. 2001, 102, fig. 8.6). It is partly overlain by an Iron Age hillfort, and the medieval St Roche's Chapel occupies the highest point. There are two radio mast compounds on the hill. The Trundle is the largest and most complex of the West Sussex enclosures, comprising at least four Neolithic earthworks, and probably more (Table 5.4). As at Whitehawk, incomplete circuits, of which Curwen's spiral ditch was one, seem to emerge from the complete ones, possibly either truncating them or truncated by them (Fig. 5.17; RCHME 1995b, fig. 5). The causewayed enclosure occupies at least 7 ha. The extent of the complex remains uncertain, because of the overlying hillfort and because of the unknown date of cropmark ditches to the west and of two cross-ridge dykes to the north (RCHME 1995b, figs 3–4).

History of investigation

This section summarises the information presented in greater detail by the RCHME (1995b, 2–7). While the highly conspicuous hillfort had long been known, the causewayed enclosure on St Roche's Hill was recognised by O.G.S. Crawford in 1925 on an aerial photograph (Curwen 1929b, pl. I). This led to earthwork survey by E.C. Curwen, achieved partly by bosing. Curwen defined two complete segmented circuits within the Iron Age ramparts (the inner ditch and the second ditch), a segmented 'spiral ditch', which seemed to spring from the south side of the second ditch and run outside it to the west but not elsewhere, and an outer ditch, which emerged from beneath the Iron Age ramparts only in the north (1929b, pl. II). This was a prelude to two seasons of excavation, in 1928 and in 1930 (Curwen 1929b; 1931), in which the segments were excavated in arbitrary spits, except for cutting II in the inner ditch, which was excavated stratigraphically in the second season (Curwen 1931, 102). This exercise established the Neolithic date of all four earthworks, and Iron Age pits were also encountered (Figs 5.18–19). It was a formative experience for the young Stuart Piggott, who prefaced his *Neolithic cultures of the British Isles* in the following terms (1954, xiii):

> The original impetus to undertake a study of the British Neolithic cultures was provided fortuitously in 1928,

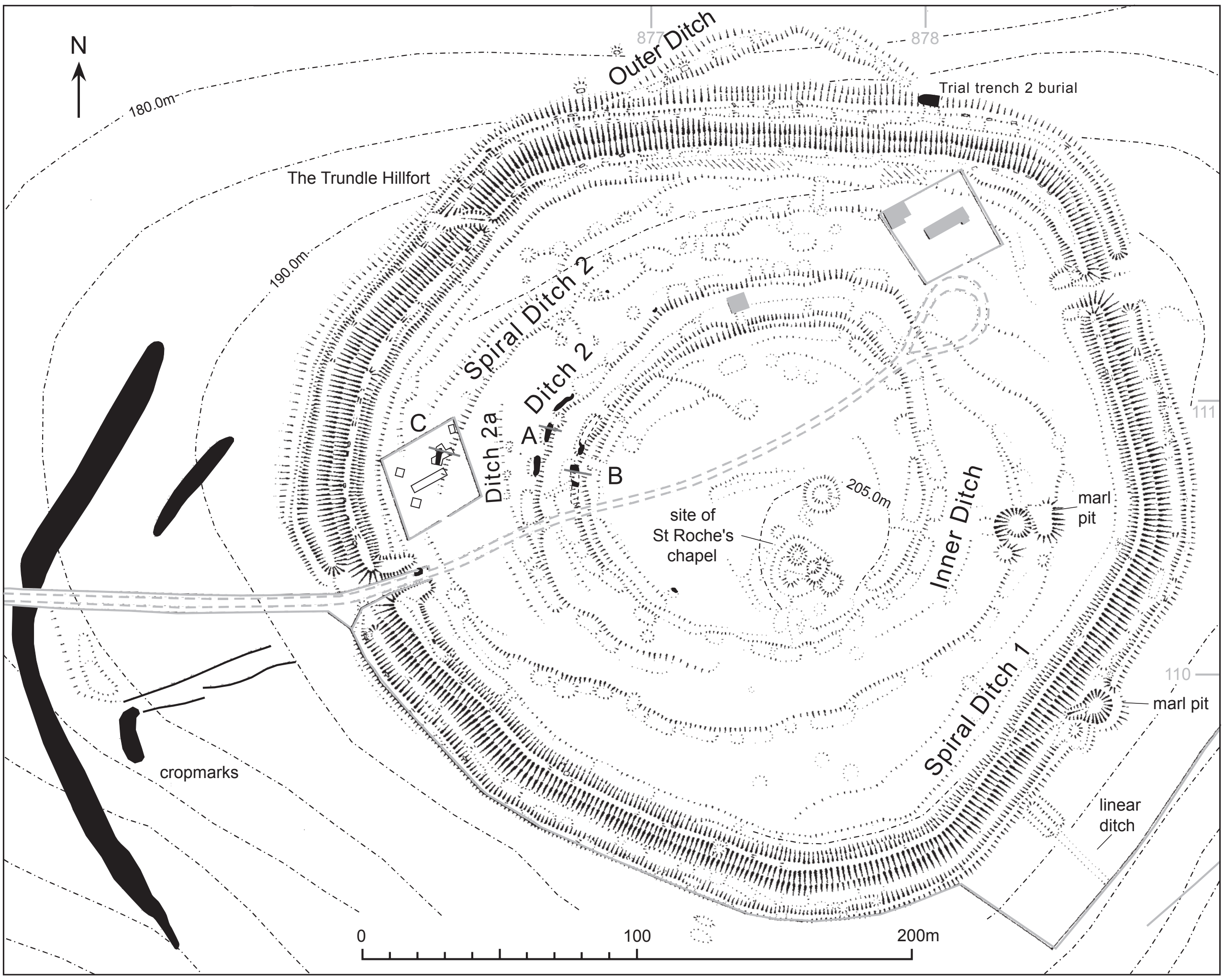


Fig. 5.17. The Trundle. Plan showing cuttings and cropmarks to the west. The nomenclature used here is Curwen's, rather than the extended suite of ditch names applied by RCHME (1995) and listed in Table 5.4. After Bedwin and Aldsworth (1981, fig. 2) and Oswald et al. *(2001, fig. 8.6).*

> when, on my first excavation, I worked with Dr E.C. Curwen at The Trundle in Sussex, the first Neolithic causewayed camp to be dug after the recognition of the type at Windmill Hill.

The inner, spiral and outer ditches appeared to have silted naturally (Fig. 5.20; Curwen 1929b, 37, 41, 46, pls III, VI; 1931, 102). An exceptional deposit was a collection of chalk blocks, some very large, and three carved chalk objects, found with 'a relatively considerable amount of charcoal' on the base of the butt of a segment of the inner ditch (Curwen 1931, 103–4, pls IIIB, IV). The segment of the second ditch excavated in 1930 had been recut when it was largely silted, and the V-sectioned recut was filled with fine dirty chalk rubble, at the base of which was 'an accumulation of chalk blocks all along the ditch, associated with hearths, pottery, bone and worked flint' (Curwen 1931, 106, pl. II). A similar feature was almost certainly present in one of the two adjacent segments which had been excavated in plan the previous year, where the 'majority of the Neolithic remains were found in a line down the centre of the ditch in spit 3' (Curwen 1929b, 41). This seems comparable with the 'black mould' of Ditches I and II at Whitehawk. A single section across the outer ditch where it underlay the counterscarp of the Iron Age rampart was extended to define the edges of the segment and to permit the recovery of a crouched burial, thought to be of Early Bronze Age date, found under a cairn of chalk lumps at the interface of the primary and secondary fills (Curwen 1929b, 46–9).[1]

The total excavated in the two seasons amounted to some 9 m of the inner ditch, 25 m of the second ditch, 6 m of the spiral ditch and less than 2 m of the outer ditch. Finds are not quantified in the reports, although the illustrations from the 1928 season show the rims of over 50 separate Bowls in the Whitehawk style (Curwen 1930, pls VIII–X, XIII), and 8 lb (3.6 kg, perhaps in the region of 700 sherds) of Neolithic pottery were found in the less extensive excavations of the 1930 season. The total of 53 serrated flakes among the struck flint from the 1928 season suggests that the 'considerable quantities of flakes' recovered amounted to a substantial industry (Curwen

Table 5.4. Certain and possible pre-Iron Age features at The Trundle, West Sussex.

Element	**Notes**	**Investigation**
Inner ditch	Complete circuit. Natural silting. Larger ditch, with longer segments and more substantial bank than D2. IA material in upper layers	4.6 m wide section excavated in W 1928, 4.6 m-wide section across same segment, and 4 m of butt of adjoining segment excavated 1930
Second ditch (D2)	Probably originally a complete circuit, close to, concentric with, and of similar plan to inner ditch (RCHME 1995b, fig. 5). Naturally silted. Much slighter than inner ditch 'Black triangle' identified only in segment excavated in 1930	2 complete segments (total length 17 m) excavated in W in 1928. Intervening segment 8 m long excavated 1930. Identification of 5 postholes around it prompted clearance of previously excavated segments, which were each surrounded by 4 postholes
Ditch 2A	Possible arc of ditch running from spiral ditch 1 to spiral ditch 2 in W, intersecting with D2 and spiral ditch 1	Recorded by RCHME 1995
Spiral ditch 1	Running from E side of ditch 2 around S of circuit to apparent end in NW between spiral ditch 2 and outer ditch, intersecting with D2, D2A, spiral ditch 2	Partly surveyed by Curwen, 1928, recorded by RCHME 1995
Spiral ditch 2	Running from E side of ditch 2 around S of circuit, under IA ramparts in SW, to apparent end in NE between D2 and outer ditch	Partly surveyed by Curwen, 1928 2.50 m wide section cut in W 1928, remaining *c.* 3 m of same segment excavated 1980 Recorded by RCHME 1995
Outer ditch 1	Emerges from hillfort ramparts on to slope to W	Identified by R. Bradley 1969 Recorded by RCHME 1995
Outer ditch 2	Emerges from hillfort ramparts on to slopes to N and to W	Plotted in N by Curwen 1928 and sectioned in approx. 1 m-wide trial trench which was extended to recover a burial, with 2 narrow slots dug to define limits of segment Recorded by RCHME 1995
W cross-ridge dyke	Across W of two spurs running N from hill	
Ditch N of W cross-ridge dyke	Ditch running across ridge to N of W cross-dyke observed by Holden 1974 (RCHME 1995, 15)	
E cross-ridge dyke	Across E of two spurs running N from hill	
Linear ditch	Emerging from hillfort ramparts in SE and running SE away from circuit. Does not extend into hillfort. Contemporary with 1st phase of hillfort?	
Interior	Only one possibly Neolithic pit encountered (Curwen's pit 4); much Neolithic pottery and struck flint on surface (RCHME 1995b, 21)	No open areas ever stripped

Fig. 5.18. The Trundle, 1930. Stuart Piggott and his father flank the middle row; Grahame Clark is in front on the left; the visitors, with nanny, may be members of the Curwen family. By kind permission of the Barbican House Museum, Lewes (Sussex Archaeological Society).

1930, 59–61; 1931, pl. IV), as does the total of 2197 pieces of struck flint recovered in 1930 (Clark 1931). Other finds included a bone phallus (Curwen 1930, pl. XV) and carved chalk, including 'cups' (Curwen 1930, 61–3; 1931, 143–4, pl. XIII). Animal bone was predominantly of cattle, with pig described as common and sheep as rarer than ox or pig (Curwen 1930, 68; 1931, 148). Iron Age material was habitually found in the upper ditch fills.

Two parallel cropmark ditches visible to the west of the hillfort on the 1925 air photograph were reinterpreted by Richard Bradley (1969) as possible components of the Neolithic complex. The only excavation after Curwen's was undertaken in 1980 in advance of the erection of a replacement microwave aerial (Bedwin and Aldsworth 1981). This entailed the exposure of a segment of the 'spiral ditch' already partly excavated by Curwen, and the excavation of its remaining fill, which confirmed that the segment had silted naturally (Bedwin and Aldsworth 1981, fig. 3), and permitted sampling for molluscan analysis and for radiocarbon dating. The Mollusca from Neolithic contexts were interpreted as showing that the enclosure was built in a recently but extensively cleared area which later became overgrown, perhaps with regenerated scrub (K. Thomas 1981a). The finds included three pieces of carved chalk from the ditch floor (Bedwin and Aldsworth 1981, fig. 4).

An evaluation during work on a car park by the Chichester District Archaeological Unit in 1994 (Kenny 1994) and a watching brief on groundworks in a radio mast compound by Southern Archaeology in 1997 (Down 1997) recorded no new archaeological features. On the site of one of the radio mast compounds, resistivity survey (Institute of Archaeology Sussex Archaeological Field Unit 1987), followed by resistivity and magnetometer survey (Geophysical Surveys of Bradford 1989), found the area much disturbed.

Fig. 5.19. The Trundle. Finds processing 1928. By kind permission of the Barbican House Museum, Lewes (Sussex Archaeological Society).

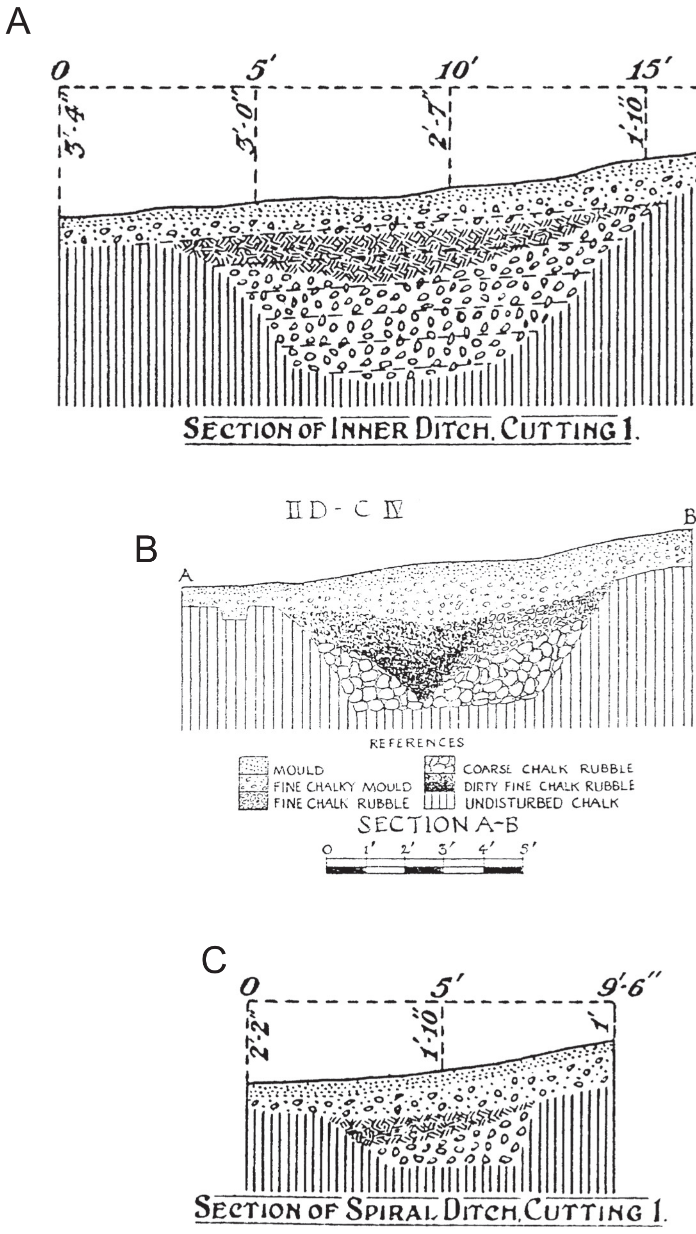


Fig. 5.20. The Trundle. Sections of inner ditch CI (A); ditch 2 CIV (B); and spiral ditch (C). After Curwen (1929b, pl. III; 1931, pl. II).

In 1995 the RCHME conducted a new earthwork survey as part of the project 'Enclosure and Industry in the Neolithic' (RCHME 1995b). This increased the extent and complexity of the probably Neolithic earthworks on the hill, identifying ditch recuts on divergent courses and what seem to be a number of overlapping, successive circuits, of which Curwen's spiral ditch was one (RCHME 1995b, figs 3, 5).

Previous dating

Stratigraphically, ditch 2 is probably meshed into a complex but unresolved set of stratigraphic relationships with the spiral ditch and other incomplete circuits, and the outer ditch pre-dates the hillfort rampart. In the 1980s, dates were obtained for disarticulated animal bone samples from Curwen's excavations in the inner ditch and the second ditch and from those of Bedwin and Aldsworth in the spiral ditch (Table 5.5: I-11612, -11614–16; Drewett *et al.* 1988, 35).

Reassessment and modelling of existing dates

Of these, I-11612 and -11614 were made on bulk samples of disarticulated animal bone which may have included material of diverse ages. I-11615–16 were made on single disarticulated animal bone samples. Any of these samples may have been already old when buried; each has therefore been used as a *terminus post quem* for the level from which it was recovered.

It has not been possible to trace full details of the chemical pretreatment of these samples, although I-

Table 5.5. Radiocarbon dates from The Trundle, West Sussex.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)
Inner ditch								
OxA-14009	Barbican House Museum, Lewes 59-17/L	Carbonised residue from 1 of 2 coarse, plain Neolithic Bowl body sherds in fresh condition, ?from same pot. Vestigial internal residue	Inner ditch. Cutting I. Spit 7. Spit 7 was the lowest in this cutting, immediately above the ditch floor, and was only 3 in (0.08 m) deep (Curwen 1929b, 79, pl. III). The sherds would have been in primary fill on or just above the ditch floor	5110±55	−30.8			4040–3770
I-11614		Cattle. Femur and other bones	Inner ditch. Cutting I. Spit 6. Spit 6 was the antepenultimate one and lay in chalk rubble, as Curwen's finds list indicates (Curwen 1929b, 79, pl. III)	4845±95				3900–3370
Ditch 2								
GrA-26817	Barbican House Museum, Lewes 59-17/K	Carbonised residue from 1 of 2 coarse, plain body sherds from different vessels in fresh condition with some internal residue	Ditch 2. Cutting I. Spit 4. Spit 4 was the penultimate one, 24–36 in (0.60–0.90 m) from the surface. The ditch base was 54 in (1.37 m) from the surface (Curwen 1929b, 39, 80). From the same spit as the sample for OxA-14024	2390±35	−30.0			730–390
OxA-14024	Barbican House Museum, Lewes 59-17/J	Carbonised residue from 1 of 2 coarse, plain body sherds from different vessels in fresh condition with some internal residue	From the same spit as sample for GrA-26817	4792±28	−26.2			3650–3520
I-11616		Cattle. Femur	Ditch 2. Cutting I. Spit 5. Spit 5 was the lowest one, at 36–54 in (Curwen 1929b, 80)	5040±170				4260–3380
I-11615		Cattle. Femur	From the same spit as sample for I-11616	5240±140				4360–3700
Spiral ditch								
I-11612		Cattle vertebra, calcaneum fragment, radius fragment; sheep/goat radius fragment; pig scapula fragment	Spiral ditch. Cutting I. Layer 4. In lowest layer of fill, which had entered from interior	4860±100				3940–3370
Outer ditch								
OxA-13935	Barbican House Museum, Lewes/B	Rib fragment from skeleton of 25–30 year-old female. Replicate of GrA-26819	Outer ditch. Trial trench 2, at interface of coarse chalk rubble (effectively primary fill) and fine chalk rubble (effectively secondary fill and in turn overlain by counterscarp bank of Iron Age hillfort), towards outer edge of ditch. Articulated, crouched, under small cairn of chalk blocks (Curwen 1929b, pls VI, VII). NB The photograph published by Oswald *et al.* as of this burial (2001, fig. 8.4) is in fact of skeleton II in ditch III at Whitehawk (compare Curwen 1929b, pls VI and VII, with Curwen 1934a, pl. XVII: 2)	2124±28	−19.6		2129±20 T'=0.1; T'(5%)=3.8; ν=1	350–90
GrA-26819	Barbican House Museum, Lewes/C	Replicate of OxA-13935	From the same context as the sample for OxA-13935	2135±30	−20.5	8.03		

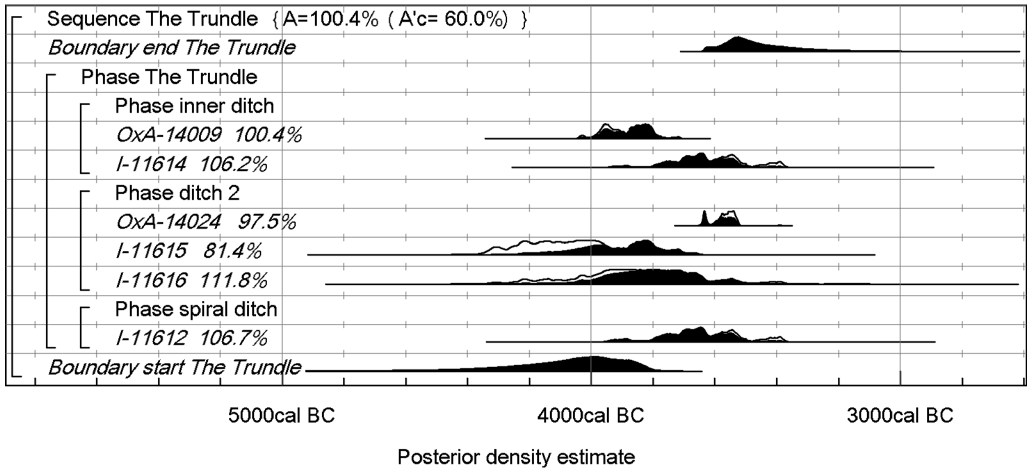


Fig. 5.21. The Trundle. Probability distributions of radiocarbon dates, assuming that all measurements are accurate and that no samples were redeposited. The format is the same as for Fig. 5.4. The square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

11514 simply received an acid wash because 'it could not withstand the treatment for removal of humic acids or sodium hydroxide soluble contaminates'. The final datelist published by Teledyne Isotopes (Buckley and Valdes-Pages 1981) states that methods, equipment and techniques were as reported by Buckley *et al.* (1968) and Buckley and Willis (1970). These publications state that samples were measured using GPC of carbon dioxide and that bone samples were processed as described by Berger *et al.* (1964), modified as described by Haynes (1967, 163). This statement is not, however, compatible with the use of sodium hydroxide on bone samples, so that there must be some doubt as to whether these protocols had been modified by the time The Trundle samples were processed. These uncertainties mean that it is difficult to assess the reliability of these measurements (see Chapter 5.6 below).

Objectives of the dating programme

Apart from the usual questions of date and sequence, there was a need to confirm or refute the potentially early date for ditch 2 which had been inferred from I-11615 (Drewett 2003, 40; Russell 1996, 58). Another question was whether the inner and second ditches were built together, given their proximity, similarity of plan and probable concentricity.

Sampling strategy and simulation

The pool of potential samples was small, partly because of selective retention of animal bone and partly because of the relatively small scale of the excavation. In the event, only four suitable samples were located.

Results and calibration

All the available dates are listed in Table 5.5. Carbonised residue from a sherd from spit 4 in cutting I of ditch 2 proved to be of first millennium cal BC date (Table 5.5: GrA-26817). The segment was excavated entirely in plan, so that no section can be consulted, although the finds table records Iron Age pottery only in spit 1 (Curwen 1930, 39, 79–80). It can only be concluded that the sherd came from an unidentified cut or was intrusive from a higher level. Also dated to the first millennium was the crouched female burial from the interface of the primary and secondary silts of the outer ditch, beneath the counterscarp of the hillfort rampart (Table 5.5: OxA-13935, GrA-26819). Both these samples are excluded from the model. As a result, there are only two new measurements on Neolithic samples from the site and these are insufficient to resolve the uncertainties of its chronology.

Analysis and interpretation

Two alternative interpretations of the Neolithic chronology are shown in Figs 5.21–2.

The model shown in Fig. 5.21 assumes that all the measurements are reliable. It demonstrates that all the dated activity probably falls in the first half of the fourth millennium cal BC, although a start of activity in the last quarter of the fifth millennium cannot be excluded, given the available evidence. Whether this model relates to the enclosure is unclear, since some or all of the dated samples may have been redeposited. The model does, however, probably estimate the date of Neolithic activity on the hill, since two of the samples were residues from sherds, one bone sample included caprine remains, there is no record that any of the cattle bones which made up the remainder were of such a size as to suggest that they were of aurochs, and there is no mention of Mesolithic lithics on the site.

Figure 5.22 takes a more conservative approach to the interpretation of these results, since there is no evidence that any of the samples was freshly deposited. In this case, the best evidence for the construction of each circuit is provided by the latest material dated from it. No chronological model is possible, since all the samples are *termini post quos.* All that can be said is that the inner ditch may date to after 3900–3370 cal BC (95% confidence; Fig.

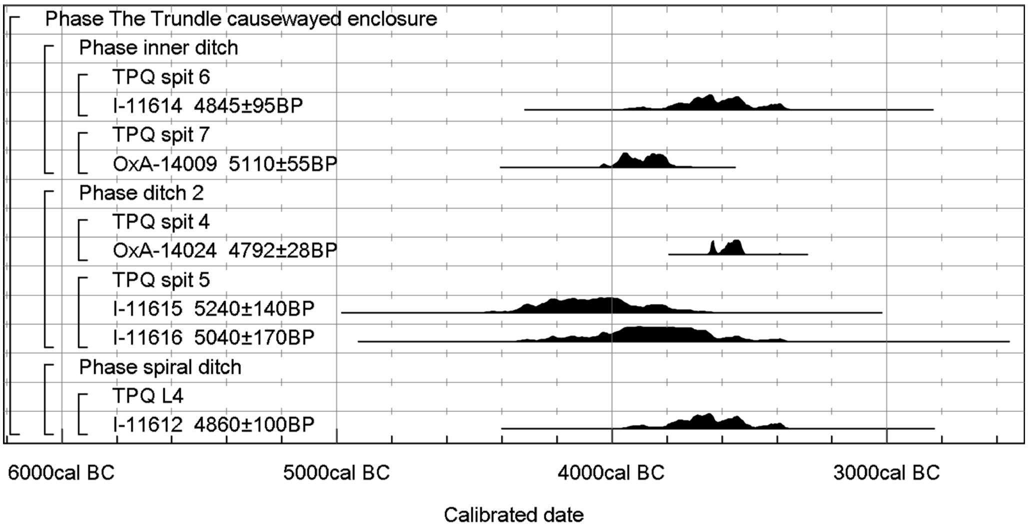


Fig. 5.22. The Trundle. Calibrated radiocarbon dates (Stuiver and Reimer 1993).

5.22: I-11614), probably after 3710–3525 cal BC (68% confidence). Ditch 2 may have been dug after 3650–3520 cal BC (95% confidence; Fig. 5.22: OxA-14024), probably after 3640–3530 cal BC (68% confidence). The spiral ditch dates to after 3940–3370 cal BC (95% confidence; Fig. 5.22: I-11612), probably after 3710–3530 cal BC (68% confidence).

The first millennium date of the skeleton from the outer ditch means that the earthwork is assigned to the fourth millennium only by its segmented form and its stratigraphic relation to the hillfort counterscarp, since finds from it amounted only to a couple of animal bones and a piece of scored chalk (Curwen 1929, 46). The date, however, provides a *terminus post quem* for the overlying counterscarp.

The existing dates are thus compatible with an initial construction date in the mid-fourth millennium cal BC or later. Any advance in our understanding of the chronology of this major complex depends on further excavation, itself not a high priority on a scheduled ancient monument which is neither under cultivation nor subject to any major threat.

5.5 Bury Hill, Houghton, Arundel, West Sussex, TQ 0023 1203

Location and topography

Bury Hill lies at 150 m OD, on Upper Chalk, on a south-east-facing slope just below the summit of a down which descends gently to the Arun valley (Fig. 5.1; Bedwin 1981, fig. 1, Drewett 1994, fig. 14). The enclosure appears continuous but for a single entrance in the west of the circuit and consists of a single pit-dug ditch with an internal bank (Fig. 5.23). It is ovoid in plan with an approximate maximum dimension of *c.* 120 m and an approximate area of 1 ha. Cross-dykes and round barrows flank it to the north and south (Fig. 5.23; Bedwin 1981, fig. 1).

History of investigation

George Holleyman recognised the site on air photographs soon after World War II. Annual ploughing in the post-war period led to its selection for rescue excavation, which was undertaken in 1979 by the Sussex Archaeological Field Unit, directed by Owen Bedwin (Bedwin 1981). The absence of any pre-modern features from two intersecting 9 m-wide cuttings made across the interior prompted the abandonment of plans for extensive excavation there in favour of the excavation of 65 m of ditch, including both entrance terminals. The ditch was between 0.80 and 1.40 m deep, and of variable profile, although always flat-based. It had silted naturally (Fig. 5.24). Finds were concentrated in localised clusters on or just above the ditch floor and were most abundant in the entrance terminals. The 65 m of excavated ditch yielded 623 sherds of Bowl pottery comparable with that from The Trundle, generally in the form of large, unabraded sherds; 4936 pieces of struck flint, including two knapping clusters on the ditch floor; 282 fragments of animal bone, generally large and well preserved; and small amounts of human bone, charcoal (mainly hazel with some hawthorn) and burnt flint. Extensive flotation yielded no carbonised grain or seeds. Artefacts and food remains were scarce in the upper fills, where small quantities of Peterborough Ware and Iron Age pottery were present. The molluscs from the Neolithic levels were dominated by shade-loving species and were interpreted as indicating that the enclosure was built in woodland, probably in a clearing (K. Thomas 1981b).

Previous dating

Two dates were obtained soon after the excavation: HAR-3595 on a broken antler pick from the floor of the ditch in area B (Bedwin 1981, 83); and HAR-3596 on a single large fragment of unidentified animal long bone also from the floor of the ditch (Table 5.7). These samples were pretreated and dated by LSC as described by Ambers *et*

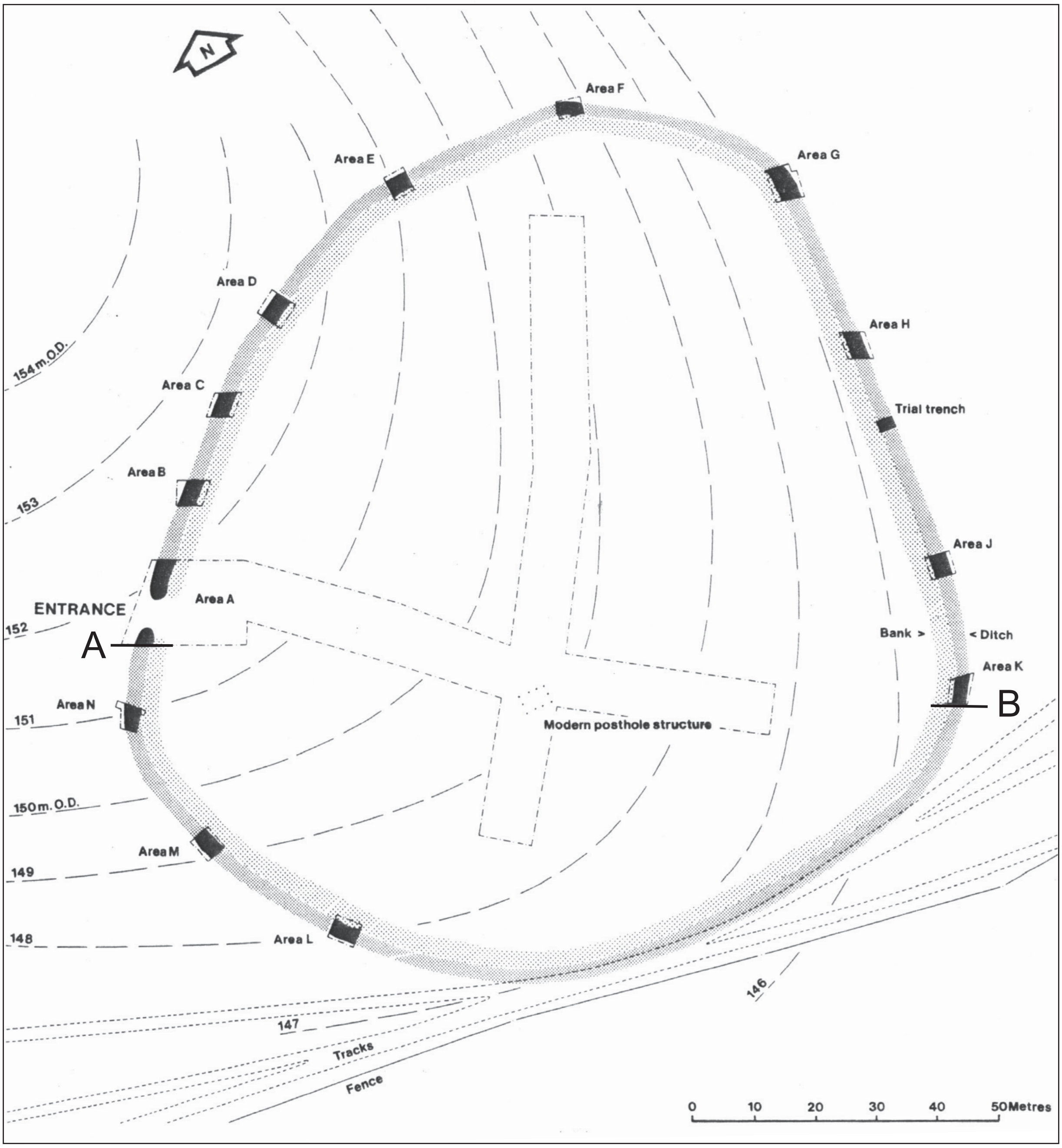


Fig. 5.23. Bury Hill. Plan showing cuttings. After Bedwin (1981, fig. 2).

al. (1989), Otlet and Warchal (1978) and Otlet and Polach (1990). The pick, given its location, was probably used to dig the ditch. Since bone from this horizon tended to come in large, well preserved fragments (Bedwin 1981, 74), the sample for HAR-3596 may have been fresh when buried, in which case both dates should be close in age to their contexts.

Sampling strategy

Potential samples with which to refine the existing measurements consisted of three articulating or fitting groups of bone, all from on or near the ditch base. Two were dated (Table 5.6: GrA-27320, OxA-14175).

Results and calibration

The four dates from the enclosure are listed in Table 5.6 and shown in Fig. 5.25.

The two new measurements on an articulating and a fitting bone samples are statistically consistent (T'=0.6; T'(5%)=3.8; ν=1). These results are not, however, consistent with the previous ones (T'=23.2, T'(5%)=7.8; ν=3), which are rather later. This difference may suggest that there is some time depth to the use of the enclosure, although given the apparently natural silting of the ditches and the scarcity of finds above their bases, this difference may in fact be the result of incomplete removal of humic acid contaminants by the pretreatment methods of the 1980s. Nonetheless, the incorporation of the new results in the model shown in Fig.

Table 5.6. Radiocarbon dates from Bury Hill, Court Hill and Halnaker Hill, West Sussex. Posterior density estimates derive from the models defined in Figs 5.25 and 5.28.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Bury Hill							
HAR-3595	BH79 1001	Red deer. Broken antler pick	Floor of ditch in area B (Bedwin 1981, 83)	4570±80	−21.2	3630–3020	*3635–3575 (9%)* or *3535–3100 (86%)*
HAR-3596	BH79 5002	Single large fragment of animal long bone	Floor of ditch	4680±80	−23.0	3640–3130	*3650–3335*
OxA-14175	BH79/46/B	Pig. Distal end of R femur with unfused epiphysis	Area J, layer 46. This was the primary silt in a cutting roughly opposite the entrance. From same context as the sample for GrA-27320	4933±32	−20.0	3790–3640	*3770–3645*
GrA-27320	BH79/46/A	Cattle. Proximal end of right metatarsal with articulating tarsal	Area J, layer 46. This was the primary silt in a cutting roughly opposite the entrance. From same context as the sample for OxA-14175	4890±45	−22.1	3770–3540	*37770–3630 (93%)* or *3555–3535 (2%)*
Court Hill							
I-12893		'just enough bone for a radiocarbon date', 7 fragments	Trench D, 'ditch floor' (Bedwin 1984, 14), 'context 5' (Bedwin 1984, 19). 5 was main chalk rubble fill, overlying the ditch floor in most of section, but preceded by 6, an earlier layer in W (Bedwin 1984, fig. 3)	5420±180		4680–3800	
OxA-14176	Chichester District Museum A20095/B	Cattle or deer. Mandible fragment	Trench D, layer 6, 'from ditch floor' (bag). 6 was the lowest layer (Bedwin 1984, fig. 3: last section). Stratified below layer 5, the context of the bulk bone sample for I-12893	4776±33	−21.6	3650–3380	*3645–3515*
GrA-27321	Chichester District Museum A20095/A	Cattle or deer. 2 mandible fragments joining along a recent break	Layer 6. No cutting is named on the bag. 6 was the lowest layer of the enclosure ditch in trenches C and D and the second lowest in trench A (Bedwin 1984, fig. 3). There was also a layer 6 in trench B, a section across a different earthwork, but this is described as yielding 'only nine flint flakes', while the bone bagged from this unlocated layer 6 includes 3 animal teeth and 8 small bone fragments and therefore almost certainly came from the enclosure	4790±45	−22.3	3660–3380	*3655–3505 (94%)* or *3400–3380 (1%)*
Halnaker Hill							
I-12322		Animal bone. 'A group of fragments'	From layer A6, low down in ditch by entrance. Section shows A6 as rubble layer in what could be a recut in A7 (primary silt; Bedwin 1992, fig. 4)	2850±90		1310–810	

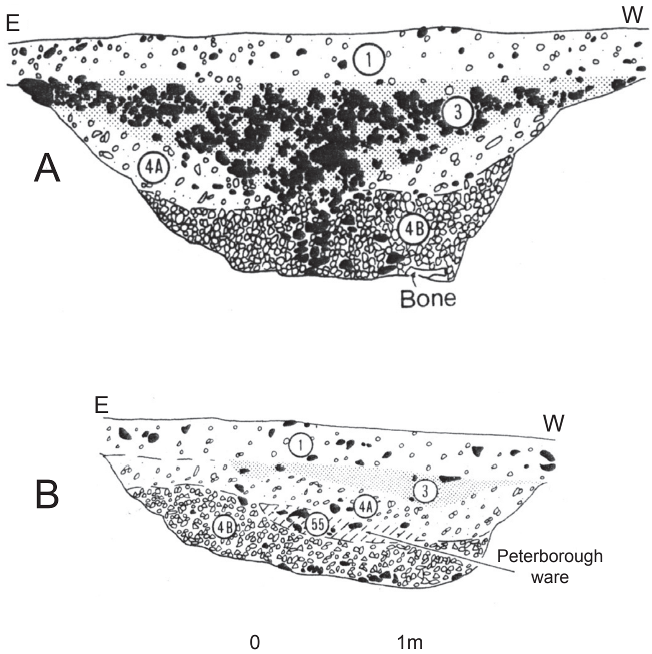


Fig. 5.24. Bury Hill. Sections of the ditch in areas A (A) and K (B). The locations of the sections are shown in Fig. 5.23. After Bedwin (1981, figs 3, 4).

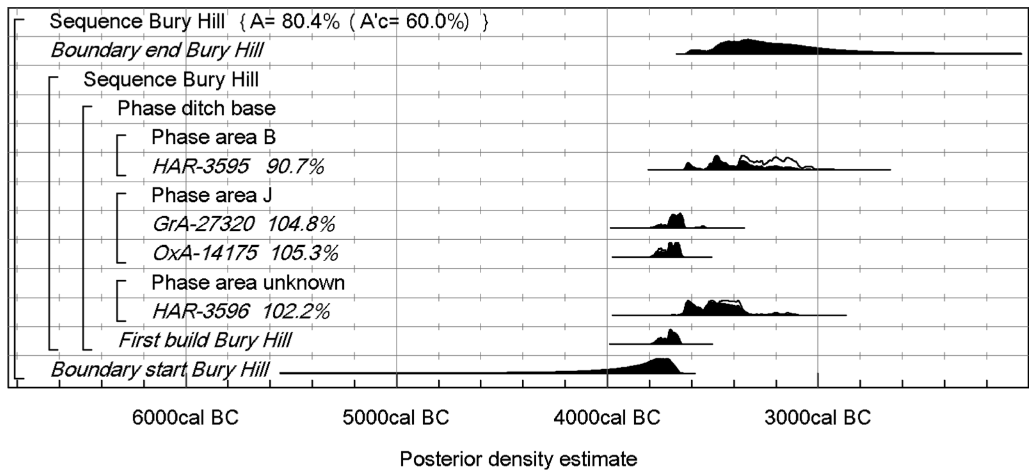


Fig. 5.25. Bury Hill. Probability distributions of dates. The format is the same as for Fig. 5.4. The square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

5.25 suggests that the enclosure was built in *3775–3650 cal BC* (*95% probability*; Fig. 5.25: *build Bury Hill*), probably in *3760–3740 cal BC* (*7% probability*) or *3715–3660 cal BC* (*61% probability*). The absence of suitable samples from higher levels means that it is not possible to calculate the period over which the enclosure was used. Their very absence, however, argues for a short period of use followed by abandonment.

5.6 Court Hill, Singleton, Chichester, West Sussex, SU 8977 1375

Location and topography

Court Hill lies at 180 m OD on a sloping, south-west-facing spur of Upper Chalk above the headwaters of the river Lavant, with easy access from the north-east but steep slopes on the other three sides (Fig. 5.1; Bedwin 1984, fig. 1; Oswald *et al.* 2001, fig. 3.3). It consists of a single sub-circular or polygonal circuit, noticeably flattened in the north-east, with an internal bank, a maximum dimension of 175 m and an approximate area of 2 ha. A separate crescentic bank and ditch with one apparent entrance lies immediately to the north, and round barrows and a field system are nearby (Fig. 5.26). The earthworks are ploughed down, but for a part of the enclosure circuit which runs through woodland.

History of investigation

The enclosure was first recorded by Eric Holden, together with the other nearby earthworks, and an area of irregular

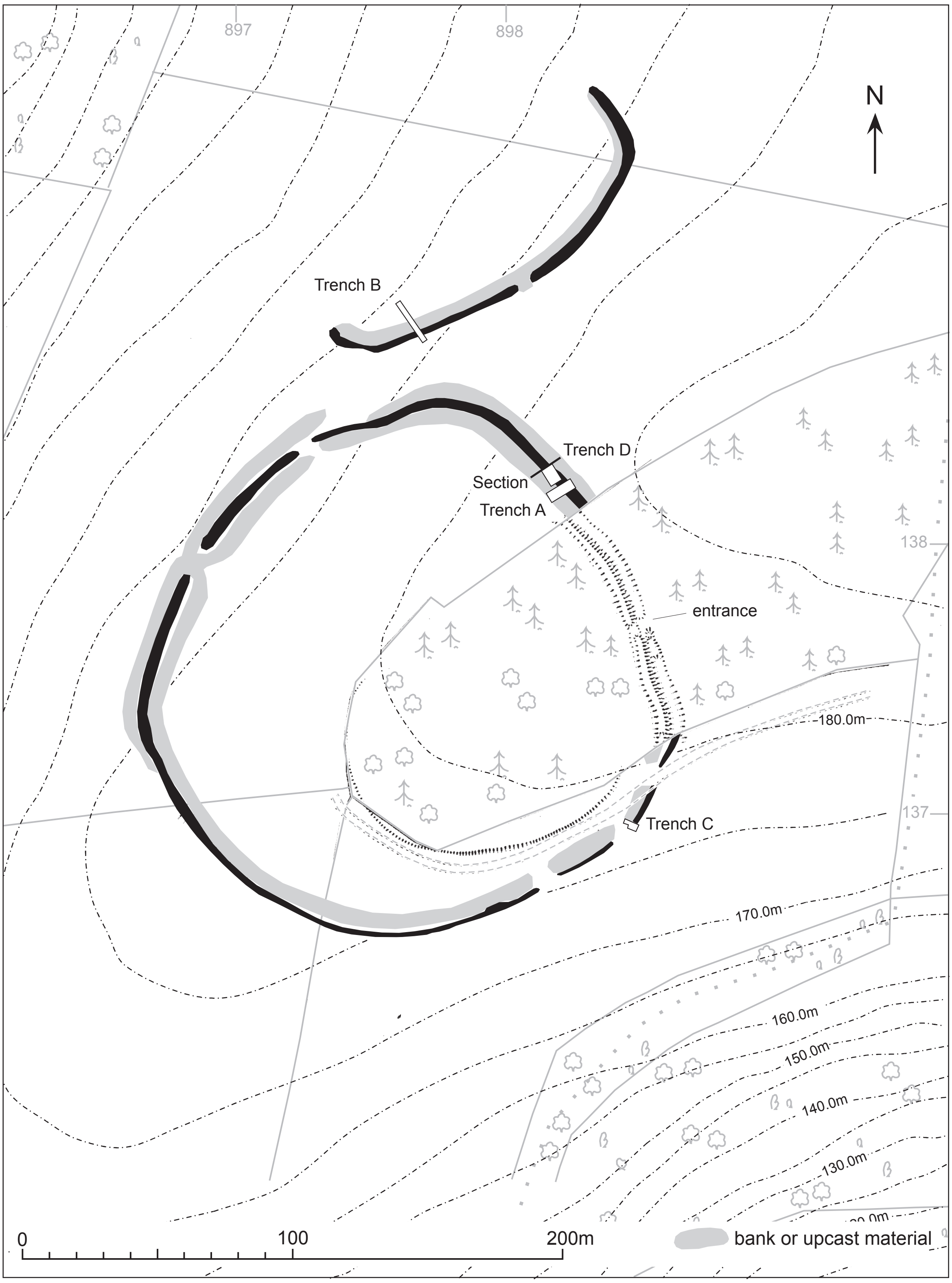


Fig. 5.26. Court Hill. Plan showing cuttings. After Bedwin (1984, fig. 2) and Oswald et al. *(2001, fig. 3.3).*

depressions, with much calcined flint and some flint-gritted pottery, the western edge of which was defined by the crescentic earthwork (1951). Trial excavation was undertaken in 1982 by the Sussex Archaeological Field Unit directed by Owen Bedwin in order to test whether the apparently continuous enclosure might, like Bury Hill, be Neolithic (Bedwin 1984). Four trenches were dug, three (A, C, D) across the enclosure circuit, excavating some 5 m of ditch, and one (B) across the crescentic earthwork. Trench C coincided with a ditch terminal, demonstrating that the enclosure was less continuous than it had appeared. The enclosure ditch was up to 1 m deep, and had silted naturally

(Fig. 5.27). Finds from it were exiguous and confined to adjacent trenches A and D: 43 pieces of struck flint, 11 sherds (1 Iron Age, the remainder in Neolithic fabrics but small and undiagnostic), and 15 identifiable animal bone and tooth fragments. Molluscs from the lower layers of the ditch were predominantly shade-loving and were interpreted as indicating that the enclosure was built in a localised and/or short-lived clearing (K. Thomas 1984).

The crescentic earthwork remained undated, although the similarity of its fills to those of the enclosure ditch and the fact that it contained only eight flint flakes suggested that the two might be contemporary.

Survey and further aerial photograph analysis by the RCHME in the 1990s revealed that the enclosure has an external bank in the north-west, in addition to the internal one, and at least six breaks in the circuit, one of them a slightly inturned entrance in the flattened north-east side (Oswald *et al.* 2001, fig. 3.3).

Previous dating

Seven animal bone fragments from the enclosure ditch in trench D were combined to provide a bulk sample for a date of 4680–3800 cal BC (95% confidence; Table 5.7: I-12893). It has not been possible to trace the precise methods used for preparing and dating this sample (see section 5.4 above). Its context is variously described as the ditch floor

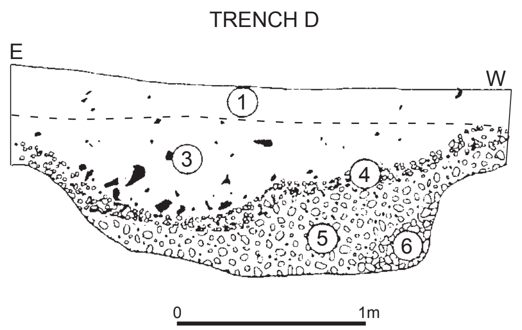


Fig. 5.27. Court Hill. Section of trench D. After Bedwin (1984, fig. 3).

(Bedwin 1984, 14) and layer 5 (Bedwin 1984, 19). Layer 5 was the main chalk rubble fill, overlying the ditch floor in most of the relevant section, but underlain by layer 6 in the west (Bedwin 1984, fig. 3). The combination of several disarticulated fragments means that the sample could have included bones of varying ages, and the date can be taken only as a *terminus post quem* for its context.

Sampling strategy and simulation

The new dating programme aimed to refine this early date. There were few potential samples from which to choose, and it was possible only to date two disarticulated animal bone fragments, one from layer 6 in trench D, stratified below the sample for the existing date, and a second also from layer 6 but from an un-named trench. This must almost certainly have come from the enclosure, since the only other layer 6 was in the ditch of the crescentic earthwork from which no bone was recovered.

Results, calibration and interpretation

The two new measurements (Table 5.6: GrA-27321, OxA-14176) are statistically consistent (T'=0.1; T'(5%)=3.8; ν =1) and both are considerably later than the pre-existing measurement on the bulk sample from the overlying chalk rubble. Indeed, if I-12893 is constrained to be later than the new measurements the overall agreement of the model is extremely poor ($A_{overall}$=3.3%). Either the measurement of this sample is inaccurate because the treatment protocol used in the early 1980s did not remove all contaminants, or the sample must have included already old material. Given the consistency of the measurements on samples from the base of the ditch, it seems plausible to suggest that they were freshly buried and not significantly reworked. If so, we can suggest that the enclosure was constructed in *3650–3530 cal BC* (*95% probability*; Fig. 5.28: *build Court Hill*), probably in *3640–3620 cal BC* (*19% probability*) or *3605–3550 cal BC* (*49% probability*).

The crescentic earthwork remains undated.

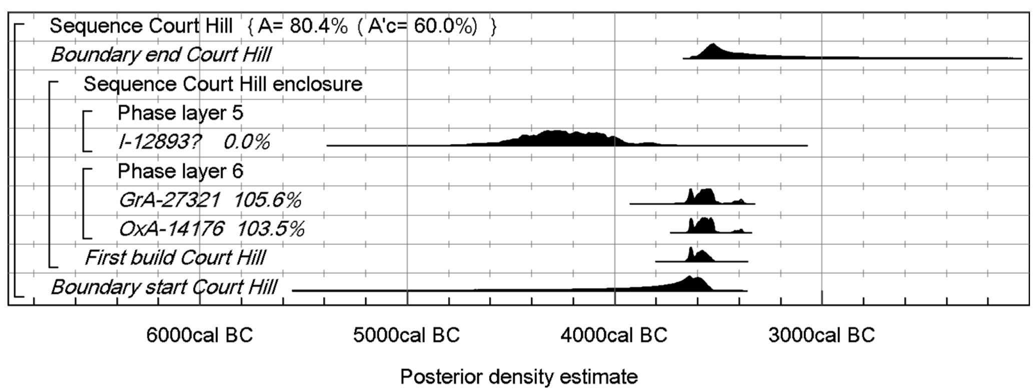


Fig. 5.28. Court Hill. Probability distributions of dates. The format is the same as for Fig. 5.4. The square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Table 5.7. Radiocarbon dates from Sussex flint mines, long and oval barrows and a pit at Bishopstone. Posterior density estimates derive from the model defined in Figs 5.32–3.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Blackpatch flint mines, West Sussex								
BM-290	61/1585/A	Red deer. Antler pick	A gallery of shaft 4	5090±130			4240–3630	*3975–3640*
Church Hill flint mines, West Sussex								
BM-181	61/1584/A	Red deer. Antler pick	Gallery	5340±150			4460–3790	*4025–3690*
Cissbury flint mines, West Sussex								
BM-183	61/1586/A	Red deer. Antler pick	A gallery	4720±150			3800–3020	*3910–3870 (1%)* or *3820–3465 (94%)*
BM-184	61/1586/A	Red deer. Antler pick	A gallery	4650±150			3710–2910	*3795–3460*
BM-185	3970	Red deer. Antler pick	Shaft 6 (gallery?)	4730±150			3900–3020	*3910–3870 (2%)* or *3825–3475 (93%)*
BM-3082	1935.46.14.1	Red deer. Antler tine	South gallery at base of mine shaft	5100±60	−19.2		4040–3710	*3970–3755 (92%)* or *3745–3710 (3%)*
BM-3086		Unidentified animal bone	Base of shaft 27	4710±60	−22.1		3640–3360	*3645–3490*
Harrow Hill flint mines, West Sussex								
BM-182	4464, H.H. 21.58	Red deer. Antler pick	Gallery	4930±150			4040–3360	*3940–3535*
BM-2099R	HH27	Red deer. Antler	5 cm above floor, on crawling floor to gallery 13 I	5040±120	−23.1		4050–3630	*3965–3635*
BM-2097R	HH43	Unidentified bulk charcoal sample	Fill of shaft 13a	5140±150	−25.2		4330–3640	*4320–4295 (1%)* or *4265–3650 (94%)*
BM-2071R	HH19	Bulk *Corylus* charcoal sample.	Shaft 13c, 0.05 m above base	4900±120	−26.7	4966±81	3955–3635	*3935–3635*
BM-2075R	HH19	Bulk *Corylus* charcoal sample. Repeat measurement of BM-2071, using fresh material	From the same context as BM-2071R	5020±110	−26.4	T'=0.5; T'=(5%)=3.8; ν=1		
BM-2124R	HH84	Unidentified bulk charcoal sample	Fill of shaft 13c, 1.50 m above base, associated with Mollusca	5060±90	−24.9		4050–3650	*4040–4015 (1%)* or *4000–3655 (94%)*
BM-2098R	HH28	Unidentified bulk charcoal sample	Fill of shaft 13g	5350±150	−25.7		4490–3800	*4465–3905 (92%)* or *3880–3800 (3%)*
BM-3084	HH 21.45	Red deer. Antler	Shaft 21, gallery 2	4880±30	−21.9		3710–3630	*3710–3635*
BM-3085	HH 21.25	Red deer. Antler	Base of shaft 25	5070±50	−23.4		3980–3710	*3960–3755 (91%)* or *3745–3710 (4%)*
Long Down flint mines, West Sussex								
OxA-1152	7008/A1/15, 8	Cattle. Scapula	From layers of dumped chalk rubble in the upper fill of a mine shaft, incorporating a sherd of Neolithic Bowl pottery and lithics including *in situ* knapping debris (Holgate 1995c)	5050±100			4050–3640	*3955–3650*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-1151	7008/A1/16, 5	Red deer. Antler tine from pick	From the same context as OxA-1152	4900±100			3950–3380	*3915–3530*
OxA-1063	7008/A2/17, 30	*Corylus* sp. charcoal	From the same context as OxA-1152	3110±80			1530–1130	
OxA-1088		*Corylus* sp. charcoal	From the same context as OxA-1152	3130±60			1520–1260	
Bevis' Thumb long barrow, East Sussex								
I-11843		*Corylus* and Pomoideae	Near W butt of S ditch, layer 8. Charcoal-rich soil containing Neolithic pottery similar to that from The Trundle, entering ditch from exterior, overlying chalk rubble primary silts (Drewett 2003)	4546±95			3630–2920	*3520–3005* (*92%*) or *2990–2925* (*3%*)
North Marden oval barrow, West Sussex								
HAR-5544	Sample 3	9 g *Quercus* sp. charcoal, 8 g *Corylus* sp., 5 g *Fraxinus* sp. General note on charcoal from the site: 'About 80% of the charcoal fragments identified appear to have come from brushwood-sized timber; the rest of the fragments (where discernible) derive from larger branches or trunk material.' (Cartwright 1986, microfiche frame 25)	Segment 6, context 65. Area of charcoal *c*. 1 x 1.4 m with Neolithic Bowl pottery, lithics, and adult male cranium within loose chalk rubble derived from barrow in recut of short segment at W end of mound (Drewett 1982, 35, 41, 42, 49)	4710±110	−26.5		3710–3100	*3765–3475*
HAR-5542	Sample 1	1 g *Fraxinus* sp., 2 g *Ulex* sp., 6 g *Quercus* sp. (Cartwright 1986, microfiche frame 24). Same general note as for HAR-5544	Ditch segment 4, context 25. Patch of ashy loam in upper ditch fill, containing burnt flint and bone and Peterborough and Beaker pottery (Drewett 1986, 33, 42, fig. 5)	3550±80	−25.3		2140–1680	
HAR-5543	Sample 2	12 g *Fraxinus* sp, 6 g *Corylus* sp., 2 g *Quercus* sp., 1 g *Crataegus* sp., 1 g *Betula* sp. (Cartwright 1986, microfiche frame 24). Same general note as for HAR-5544	Ditch segment 5, context 55. Topmost fill of ditch (Drewett 1986, fig. 5: I–J)	3590±80	−27.6		2200–1730	
Alfriston oval barrow, East Sussex								
HAR-940	A4	Red deer. Antler pick (Drewett 1975a, fig. 12:34)	Ditch 2, layer 6. Bottom layer of ditch, with early Neolithic pottery and struck flint (Drewett 1975a, 126, 151, fig. 3, fig. 7: O–P)	4310±110	−22.5		3340–2620	

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
HAR-942		Human. Bones of one leg from articulated crouched burial probably female adult. (Drewett 1975a, 126, 144–5, 151, fig. 8. pl. XII; Jordan *et al*. 1994, 4). Replicate of HAR-1811	Base of burial pit on axis of mound of oval barrow. Stratigraphic relation to mound uncertain because mound badly ploughed, and because of cut made into mound in area of grave in C19 (Drewett 1975a, 121–7, figs 4, 5)	2590±90	−23.5	T´=24.6; T´(5%)=3.8; ν=1		
HAR-1811		Replicate of HAR-942, on bones of second leg	From the same burial as HAR-942	3190±80	−22.5			
HAR-941	A1	Red deer. Antler pick	On buried land surface *c*. 2.5 m N of burial pit (Drewett 1975a, 124, fig. 3)	2540±70	−23.3		830–400	
Bishopstone, East Sussex								
HAR-1662	BI3574-7	Bulk charcoal sample. Charcoal from the pit as a whole was identified as *Fraxinus* sp., *Corylus* sp., *Crataegus* sp., *Quercus* sp. and *Taxus baccata* (Cartwright 1977)	Pit F357, layers 4–7. One of the larger examples among at least 10 Neolithic pits, found with possibly contemporary scoops and gulleys. In F357 a layer of backfill over a skin of initial silt contained numerous mussel shells and smaller numbers of other marine molluscs. One of 3 scoops from this layer contained burnt material including charcoal of grasses, twigs and wood. Above these there was further backfill. All layers, especially the last, were rich in finds, including 153 sherds from 32 pots, one of them incorporating non-local metamorphosed limestone and all comparable in form and decoration to the assemblages from Whitehawk and The Trundle; 770 pieces of struck flint, including a high frequency of serrated blades and a flaked axehead of flint distinct from the rest of the assemblage; and a saddle quern fragment. There were also grains of emmer wheat, barley and weeds of cultivation and bone of cattle, caprine and pig as well as a roe deer antler. Molluscs from a sample from the top of the pit suggested a mosaic of grassland and scrub (Bell 1977, 9–31, 266–90)	4460±70	−25.6		3370–2900	

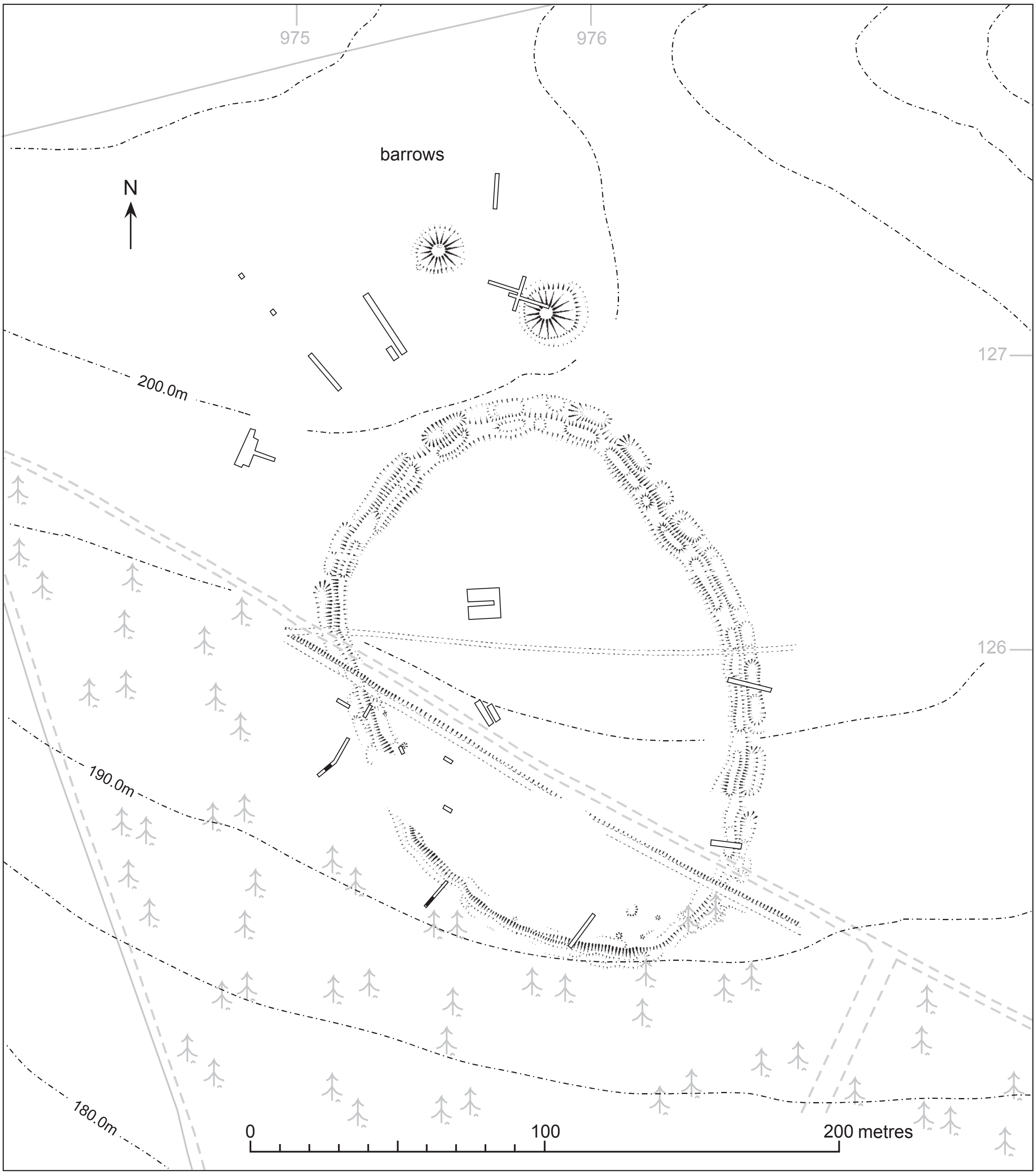


Fig. 5.29. Barkhale. Plan showing cuttings. After Leach (1983, fig. 2) and Oswald et al. *(2001, fig. 3.10).*

5.7 Barkhale, Bignor Hill, Arun, West Sussex, SU 9758 1261

Location and topography

Barkhale lies at 200 m OD between the two summits of Bignor Hill, on a south-facing slope of Upper Chalk (Fig. 5.1; Drewett 1994, fig. 14). It consists of a single ovoid circuit of well preserved earthworks, enclosing some 2.80 ha, in which bank and ditch segments seem to be of equal length (Fig. 5.29). Round barrows were later built to the north.

History of investigation

The enclosure was recognised by Professor Ryle in 1929 and surveyed, partly by augering, in 1930 by Curwen and Burstow (Curwen 1954, fig. 18) the year in which Ryle also cut a single section. Further excavation was

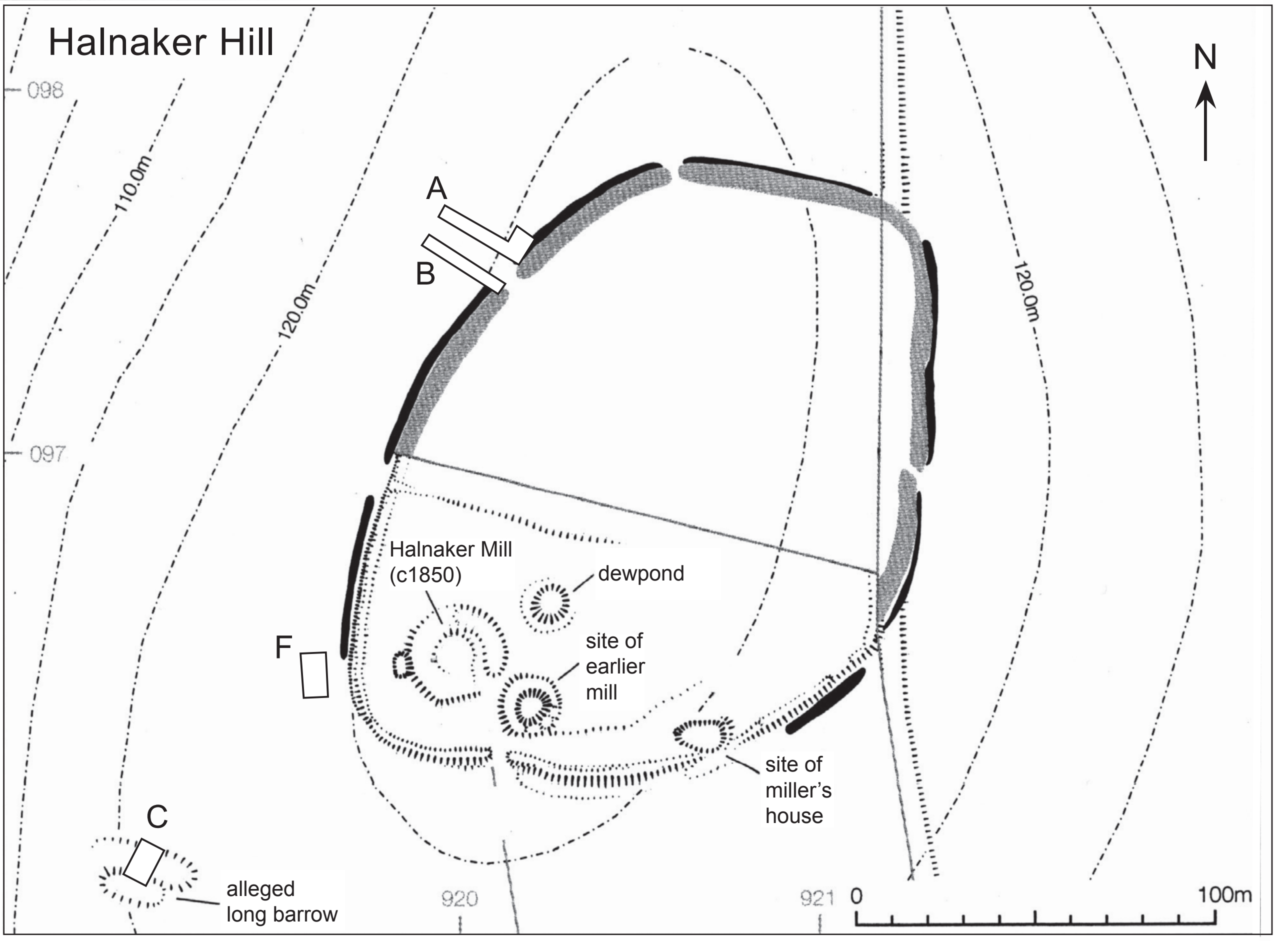


Fig. 5.30. Halnaker Hill. Plan showing cuttings. After Bedwin (1992, fig. 2) and Oswald et al. *(2001, fig. 8.12).*

undertaken by Veronica Seton Williams in 1958–61, as a training excavation for extra-mural students, following severe plough-damage to the northern part of the circuit. In the course of this exercise, 20 small and generally very narrow trenches were dug across the northern part of the circuit and in the interior. Segments were 3.90–4.90 m long and 0.91–1.50 m deep. There was much clay in the ditch fills, suggesting a cover of Clay-with-Flints over the chalk, and conditions were generally acidic, so that bone did not survive (P. Leach 1983, 22). There was a little Neolithic pottery, 'so undistinguished as to defy further comment', and early and middle Bronze Age sherds, as well as Iron Age wares, came from upper and superficial levels (I. Smith 1983). 'Large quantities' of struck flint remain unquantified, at least in print (Clipson 1983).

Further excavation was undertaken in 1978 by the Sussex Archaeological Field Unit, directed by Peter Leach, this time in the south of the circuit following tree felling. Mounds investigated in the interior proved to be recent; the ditch was also sectioned in two places. There was more chalk in the fills here and the ditch seemed to have silted naturally (P. Leach 1983, figs 7–8). Neolithic pottery remained scarce, and 465 pieces of struck flint came from ditch fills, a surface scatter being observed within and to the south of the enclosure (P. Leach 1983, 25–8). Molluscs survived in small numbers in layer 3 (the penultimate layer) of the ditch and were predominantly shade-loving (K. Thomas 1983b).

No radiocarbon dates had been obtained prior to this project and it was not possible to locate any suitable samples in the course of it.

5.8 Halnaker Hill, Boxgrove, Chichester, West Sussex, SU 9200 0965

Location and topography

Halnaker Hill lies at 125 m OD on a south-facing spur of Upper Chalk capped by Clay-with-Flints, running off the summit to the east (Drewett 1994, fig. 14) and overlooking the Long Down flint mines (Fig. 5.1). It consists of a single causewayed circuit, of partially angular layout, with an inturned entrance in the south (Fig. 5.30). Some of it survives as a slight earthwork enclosing some 1.7 ha (Oswald *et al.* 2001, fig. 8.12). A possible long barrow lies to the south-west, round barrows and a field system to the south (Bedwin 1992, figs 1–2).

History of investigation

The enclosure was long thought to have a single entrance in the north-west, and its investigation was prompted by

the Neolithic date established for Bury Hill. Small-scale excavations were undertaken by the Sussex Archaeological Field Unit under the direction of Owen Bedwin in 1981–3, with the aim of dating the enclosure and the adjacent earthworks (Bedwin 1992). Three sections were cut across the enclosure ditch, two of them on either side of the north-west entrance, 12 m of ditch being excavated. The ditch was pit-dug and flat-bottomed; a mass of loose, unweathered chalk slabs (context 6) above the initial silts was tentatively interpreted as natural collapse of or deliberate infilling with bank material. Above this deposit the ditch had silted naturally. Finds were virtually confined to the entrance area and included 15 sherds of Neolithic Bowl, as well as one of Peterborough Ware from an upper layer; a perforated chalk disc; 279 pieces of struck flint; and 17 fragments of cattle, sheep and pig bone. The Mollusca from the ditch fills indicated that the enclosure had been built in a cleared area but may soon have been abandoned to deciduous woodland (K. Thomas 1992).

Subsequent aerial photograph interpretation and earthwork survey identified a number of causeways in the circuit, including a slightly inturned entrance in the south (Oswald *et al.* 2001, 49–50, fig. 8.12).

Previous dating

A bulk animal bone sample from context 6 (loose, unweathered chalk slabs above the initial silts) in the north entrance butt (Bedwin 1992, fig. 4: sections A–B, C–D) was dated to 1310–810 cal BC (95% confidence; Table 5.6: I-12322), prompting the conclusion that either the enclosure is indeed Neolithic and the date is a 'rogue' one or that early Neolithic material was redeposited in a later Bronze Age enclosure (Bedwin 1992, 11).

This programme

It was not possible to obtain further dates because the remaining finds, which had remained in private hands, could not be located. The first of Bedwin's alternatives seems the more plausible, because first millennium enclosures are generally finds-rich, so that it would be strange for one to contain only Neolithic material, and because the form of the enclosure looks increasingly Neolithic.

5.9 Discussion

Syntheses and models of the Sussex enclosures have often been made, perhaps encouraged by their geographical concentration and apparent isolation. For Stuart Piggott, whose enthusiasm for the period had been fired at The Trundle, Sussex was part of his Windmill Hill culture, focused on the chalklands and characterised by its long barrows, causewayed enclosures and flint mines (1954, 17–101). Later commentators, notably Peter Drewett, whose involvement in the area ensued from his role as Director of the Sussex Archaeological Field Unit, have tended to emphasise the characteristics which distinguish Sussex from its neighbours. In the late 1970s, Drewett envisaged a string of 13 territories along the Sussex Chalk, each 8 km in diameter, including downland and lower ground, some of them centred on enclosures, and most of them incorporating sources of high quality flint in the form either of flint mines or cliff exposures. Each clan or extended family might maintain its own long barrow, but several of them would group together to build a causewayed enclosure or dig a flint mine (Drewett 1977, 226–8; 1978, 28–9). A decade later, Whitehawk in the east and The Trundle in the west were seen as fortified settlement enclosures, at the head of an organisational hierarchy which encompassed the remaining enclosures, seen as ritual or ceremonial, as well as unenclosed settlements of varying sizes and degrees of permanence. An explicit link was made between the fortified settlement enclosures and flint mines, since 'the large-scale activity of flint mining, involving a greater labour input, is more likely to have been undertaken from the fortified settlement enclosures, with their larger population, than from the open agricultural settlements' (Drewett *et al.* 1988, 60–2). By the 1990s, three larger territories were envisaged, centred on The Trundle, Whitehawk and Combe Hill, this last being seen as the final enclosure to be established in a spread of Neolithic ideas from west to east, and hence never having developed from a ritual or ceremonial enclosure to a fortified settlement enclosure (Drewett 1994, 19–24, fig. 1; 2003, 45).

Ian Kinnes subsequently questioned the validity of distinguishing separate territories on blocks of downland when each has a different combination and density of monuments (1992, 77–8, table 2:3.3, fig. 2.3.3). Miles Russell echoed Kinnes' view, emphasising both the clustering of enclosures and long barrows on either side of a central 'mining block' between the Arun and the Adur (2001b, 226) and the presence of long barrows without enclosures on the Hampshire Downs to the west (Russell 1997). He subsequently constructed a scheme based on available radiocarbon dates which began with a primary phase of monument building on the South Downs, in 4500–3500 cal BC, comprising Court Hill, the earliest circuits at The Trundle and possibly Whitehawk, Combe Hill and Offham Hill, together with the first mine shafts at Blackpatch, Church Hill, Harrow Hill and Long Down (Russell 2002, 141–3; 2004, fig. 19.4). Both enclosures and mines would have been 'seasonal anchor points' for dispersed communities, at which the deposition of material representing each group helped 'emergent Neolithic society to imprint its own specific social identity into the landscape' (2002, 143). His secondary phase of monument construction and redefinition in 3500–2500 cal BC included the elaboration of existing enclosures, the construction of the remainder, the first mine shafts at Cissbury together with continued mining in the other complexes, and the construction of all the long and oval barrows, which, like the enclosures and mines, were 'cultural archives' placing or increasing a claim over land (2002, 143–5; 2004, fig. 19.5). This could have reflected the establishment of defined, discrete territories or a continued wish to impose

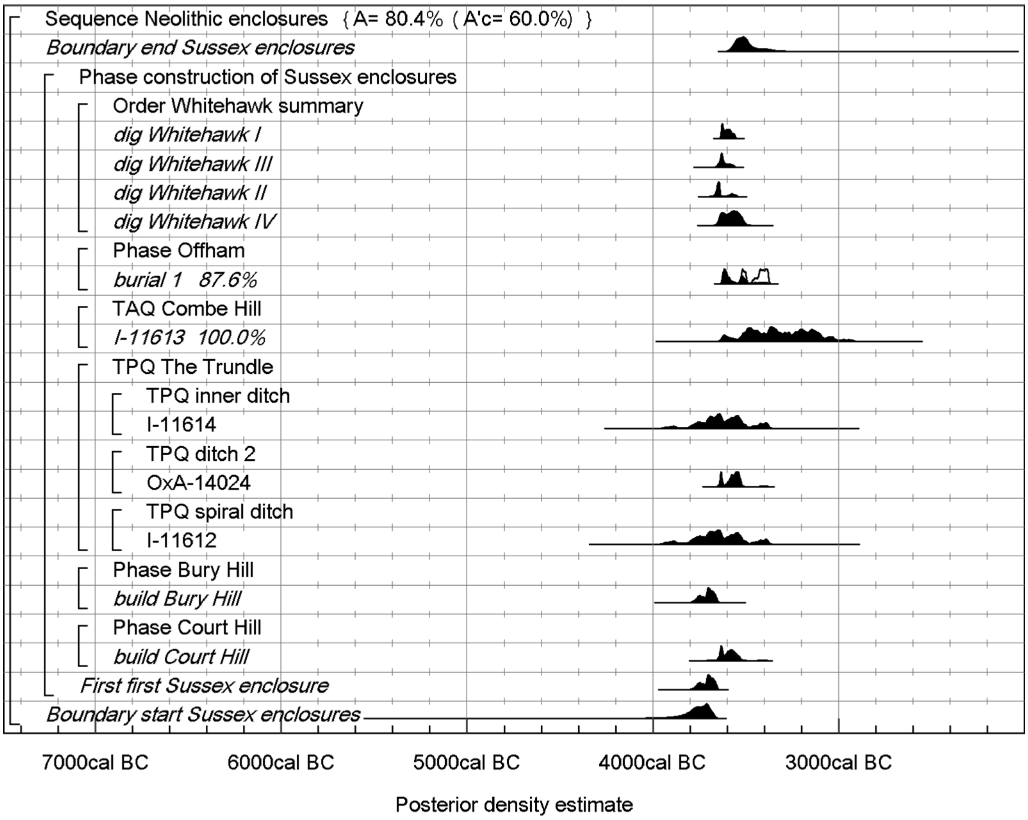


Fig. 5.31. Sussex. Probability distributions of construction dates of circuits from causewayed and other early Neolithic enclosures, taken from the models defined in Figs 5.5–9, 5.14, 5.25 and 5.28. Dates from Combe Hill and the Trundle have been simply calibrated. This model estimates the period during which the circuits were constructed. The format is the same as for Fig. 5.4. The square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

order on the Downs by establishing a frame of reference, the elaboration of existing enclosures perhaps reflecting their use by more people or a desire to preserve and enhance their visual impact with fresh, white chalk.

Enclosures

Our estimates for the chronology of enclosures in Sussex are less satisfactory than those for some other regions. Various factors are responsible. While the complex and extensive layouts of Whitehawk and The Trundle were accompanied by abundant finds, other Sussex enclosures had rather little material in their ditches and other contexts. This is not just a question of limited excavation: witness Offham Hill and Bury Hill. We have been able to use the archives of the 1920s and 1930s, for Whitehawk especially, to some effect. It is disquieting, however, that the records of some enclosure excavations of the 1970s have proved elusive, although the finds are, with one exception, in the public domain. Most of the Sussex sites simply provide too few suitable dating samples to provide robust chronologies.

Nonetheless, a model for the period during which enclosures were constructed in Sussex is shown in Fig. 5.31. This suggests that the first dated enclosure in Sussex was constructed in *3775–3655 cal BC* (*95% probability*; Fig. 5.31: *first Sussex enclosure*), probably in *3760–3740 cal BC* (*7% probability*) or *3715–3660 cal BC* (*61% probability*). All the circuits so far dated appear to have been built by *3600–3300 cal BC* (*95% probability*; Fig. 5.31: *end Sussex enclosures*), probably by *3570–3470 cal BC* (*68% probability*). Bury Hill was built first (*98% probable*), probably in the last decades of the 38th century cal BC or the first half of the 37th century cal BC (Fig. 5.31: *build Bury Hill*). New enclosures came thick and fast during the following 100 years, although the order of their construction is uncertain. It seems that Court Hill and the outer ditch at Offham Hill may be later rather than earlier in the sequence, falling perhaps at the end of the 37th century cal BC or in the 36th century cal BC. If we follow the arguments of Ken Thomas, set out above, for the sequence at Offham Hill, the inner circuit at that enclosure may be slightly earlier. Again it is worth emphasising the small number of samples from these sites.

Among the enclosures, the precedence of Bury Hill (Fig. 5.31) gives some slight support to Drewett's west-to-east constructional sequence, although the date at which The Trundle began to be built remains unknown. The salient point here is one of morphology and history rather than one of sequence. Most of the investigated Sussex sites seem to have undergone little modification after their construction, apart from a localised recut at Combe Hill, and seem to have been left to silt naturally after their often brief initial use, even in the case of the two circuits

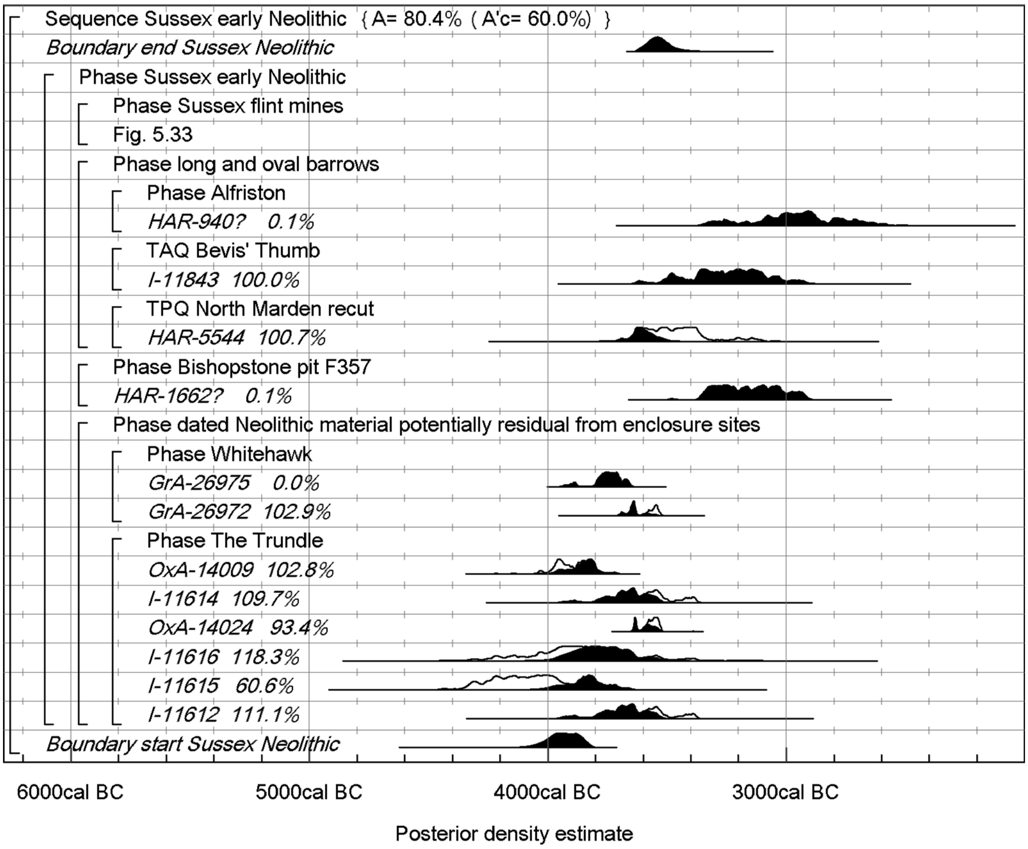


Fig. 5.32. Sussex. Probability distributions of dates with diagnostically early Neolithic associations (including potentially redeposited samples from enclosure sites). The format is the same as for Fig. 5.4. The component section relating to flint mines is shown in Fig. 5.33. The square brackets down the left-hand side of the diagrams, along with the OxCal keywords, define the overall model exactly.

at Offham Hill, which may have been built at different times (Figs 5.13, 5.16, 5.24, 5.27). The two exceptions, The Trundle in the west of the county and Whitehawk in the east, have several features in common. They have complex plans and sequential construction, especially in the overlapping, fragmentary 'spiral' circuits which show clearly at the Trundle (Fig. 5.17) although they are less well preserved at Whitehawk (Fig. 5.2); it is noteworthy that, although the RCHME conducted earthwork surveys of numerous enclosures in the 1990s, it was only at these two sites that such features were so frequent. Each eventually came to be larger than the surrounding enclosures. At least some of the ditches of each were recut when largely silted and rich deposits of cultural material were placed in them. Both have at least the possibility of Neolithic outworks. This corresponds to Drewett's distinction between ritual or ceremonial enclosures and fortified settlement enclosures and to Russell's distinction between progressively expanded sites and the rest (2004, 173–4), but could invite other interpretations. One possibility is that a single site in each area became dominant and was frequented by an increasing population, including those communities who had originally built and used the other, eclipsed, enclosures.

Other aspects of the early Neolithic in Sussex

Turning to other aspects of the early Neolithic in Sussex, we face similar limitations. Occupation sites and long barrows are under-investigated. Some pit clusters are known, mainly from the downs, but only one pit, from Bishopstone, has been radiocarbon dated (Drewett 2003, 43–4). More long and oval barrows have been recognised in recent years but only three have provided radiocarbon dates (Drewett 2003, 41). Comparatively little is known of the flint mines, but the date estimates so far possible suggest an early position for this distinctive, regionalised phenomenon, relative to that of the enclosures.

A chronological model for early Neolithic activity in Sussex other than enclosures is given in Figs 5.32–3. Figure 5.32 shows the overall form of the model with the component section relating to flint mines being given in Fig. 5.33. In this model, all the samples from the flint mines are included as representing separate early Neolithic events. Measurements from eight samples, which have been interpreted as residual in the analyses of the causewayed enclosures of Whitehawk and The Trundle (Figs. 5.5–9 and Figs 5.21–2), are included in this model. Three of these are measurements on carbonised residues adhering to the interior of Neolithic sherds (Fig. 5.32: *GrA-26975, OxA-14009, -14024*). The other five samples (Fig. 5.32: *GrA-*

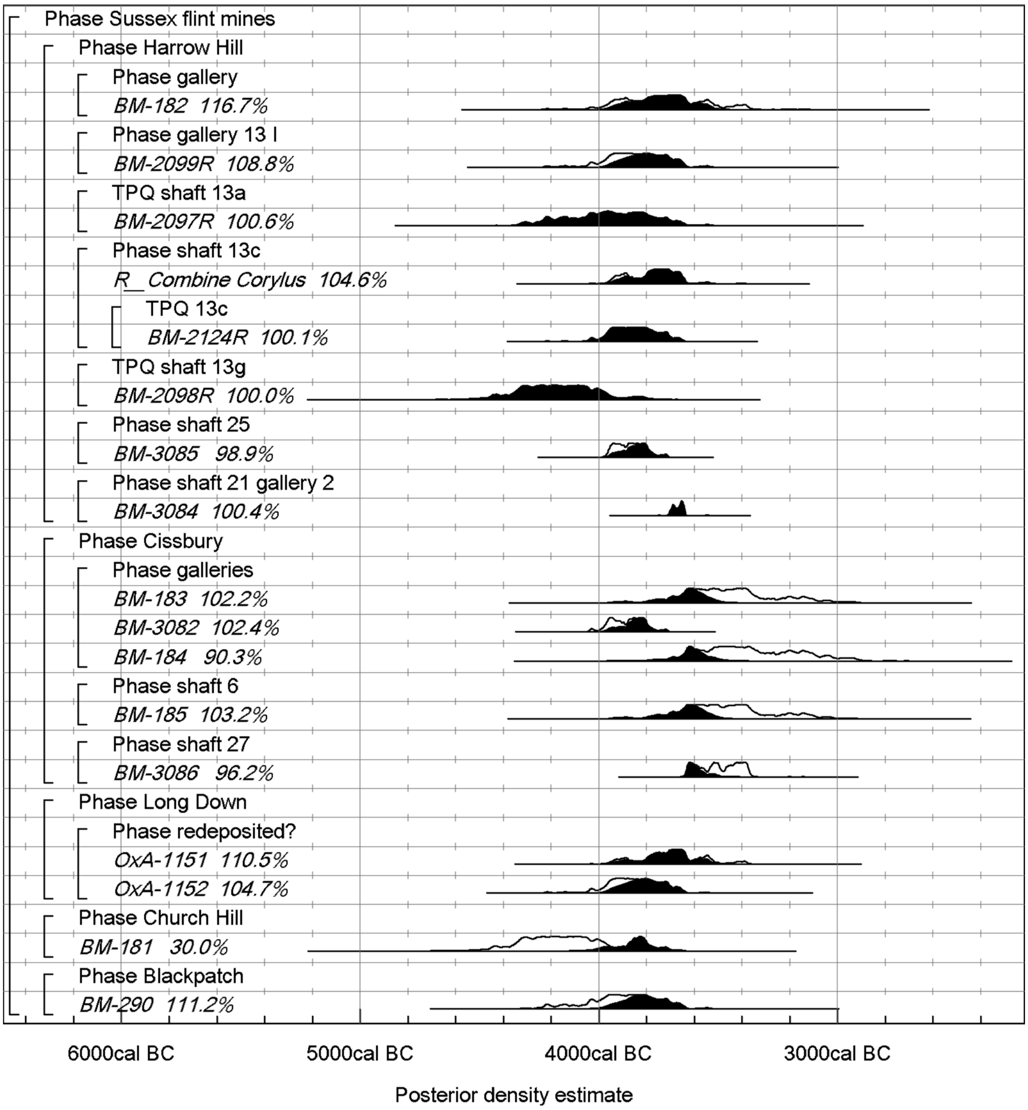


Fig. 5.33. Sussex flint mines. Probability distributions of dates. The format is the same as for Fig. 5.4. The overall structure and other components of this model are shown in Fig. 5.32.

26972, I-11612, -11614–6) are from cattle bone, which we have taken as domesticated in the absence of evidence to the contrary. These samples represent Neolithic activity in Sussex, which may relate to the enclosures from which they were recovered or to previous activity on these sites.

Long and oval barrows

Long and oval barrows cluster with the enclosures in East Sussex and lie to the west of the enclosures in West Sussex (Drewett 2003, fig. 4.1), extending discontinuously on to the Hampshire Chalk (RCHME 1979, fig. 1; Russell 2001a, fig. 7.1). Although there are up to 20 in Sussex (including a recent discovery: Bewley *et al.* 2004, fig. 7.1), little is known of them. A trench across the ditch of a West Sussex long barrow known as Bevis' Thumb yielded a bulk sample of short-life charcoal from a tip of burnt material, including pottery similar to that from The Trundle and Whitehawk, which overlay *c.* 0.50 m of primary chalk rubble (Drewett 1981, fig. 3: layer 8). Since the tip was a distinct event and the underlying rubble could have accumulated quickly, the sample is likely to date from not long after the construction of the mound, and provides a *terminus ante quem* for that event of *3520–3005 cal BC* (*92% probability*; Fig. 5.32: *I-11843*) or *2990–2925 cal BC* (*3% probability*), probably *3490–3470 cal BC* (*3% probability*) or *3375–3095 cal BC* (*65% probability*).

In a recut of part of the ditch of a ploughed-down oval barrow at North Marden, just over 1 km east of Bevis' Thumb, a deposit of charcoal, plain Bowl pottery and a human cranium yielded a bulk charcoal sample including long-lived species. This provides a *terminus post quem* for the recut of *3765–3475 cal BC* (*95% probability*; Fig. 5.32: *HAR-5544*), probably *3650–3545 cal BC* (*68% probability*). If the silting of the ditch prior to recutting was quite rapid, the date may also be a *terminus post quem* for construction.

An antler pick from the lowest layer of the ditch of a second oval barrow on Alfriston Down in East Sussex, close to a long barrow, provides a rather later date (Table

5.7: HAR-940). The accuracy of this measurement must be open to doubt, however, since a measurement on one leg of the central, flexed inhumation made at the same time is significantly younger than a replicate on the other leg made subsequently (Table 5.7: HAR-942, -1811; T'=24.6; T'(5%)=3.8; ν=1). An antler pick on the protected chalk formerly covered by the mound also falls in the first millennium cal BC (Table 5.7: HAR-941). The mound was badly ploughed, ploughmarks sometimes cutting into the old land surface (Drewett 1975a, 124, figs 4–5), so that the stratigraphic relation of both burial and antler to the mound was unclear, a situation exacerbated in the case of the burial by an earlier excavation. The burial and the pick must result from later reuse of the mound (Drewett 2003, 41). The barrow itself, however, is almost certainly Neolithic, as indicated by its form, and by the knapping clusters and pottery from the ditch (Drewett 2003, 41).

With Sussex long and oval barrows at present in chronological limbo, the most securely dated burials of the mid-fourth millennium are from Whitehawk (Fig. 5.7: *skeleton III*; Fig. 5.8: *GrA-26971*, *skeleton IIa*) and from Offham Hill (Fig. 5.14: *burial 1*). Undated skeletons in three mineshafts at Cissbury (Topping 2004, 185–6) may be contemporary or later.

Settlement

Analysis of a rich stock of surface collections from East Sussex has shown that concentrations of leaf-shaped arrowheads tend to lie 3 km or more away from each of Whitehawk, Combe Hill and Offham Hill and to coincide with patches of Clay-with-Flints, as do most of the long barrows. If these concentrations bear any relation to day-to-day living, then some of its activities may have been focussed on the perhaps originally loessic soils formed on the Clay-with-Flints, away from the major aggregation sites (Gardiner 1984, 20–2). A closer sight of such scatters is afforded by excavation and systematic collection on Bullock Down, Eastbourne. Here, where there is ample evidence for the extraction and working of flint from the Clay-with-Flints, small quantities of plain Bowl pottery and larger quantities of early Neolithic lithics occurred at Belle Tout and in Drewett's area C, both of which were also used in later periods (Drewett 1982, 45–57; Bradley 1982).

Pits have rarely been investigated in Sussex (Drewett 2003, 43, fig. 4.1). The only dated example, the most prolific of ten excavated at Bishopstone near Newhaven in East Sussex, contained a rich and complex deposit including fragments of 32 pots comparable in form and decoration to the assemblages from Whitehawk and The Trundle, as well as a flint industry with numerous serrated flakes, a quern fragment, charred cereals and weeds, and a small amount of animal bone (Bell 1977, 7–44). A bulk charcoal sample of mixed species, included long-lived ones, was dated to 3370–2900 cal BC (95% confidence; Table 5.7: HAR-1662). This was bulked from several layers in the pit and may contain material of different ages. It has therefore been excluded from the model. To the west, very different pottery came from a deposit of burnt material on the base of a pit on New Barn Down, Patching, a spur of Harrow Hill some 750 m south of the flint mines (Curwen 1934b, 153–6). This contained sherds of at least five Bowls, all plain, thin-walled and light-rimmed and at least two of them carinated (Piggott 1934, figs 29, 30–36a). A connection with the Harrow Hill flint mines, with their apparently early fourth millennium cal BC origins (Fig. 5.33) is suggested by a 'Cissbury type' flaked flint axehead from the pit (Clark 1934a). On the Downs to the north of the Trundle, excavations conducted to locate Saxon settlement revealed a pair of pits and a further row of three some 100 m south of the North Marden oval barrow. The charcoal-rich fills of the pair and one of the row contained animal bone, a flint assemblage and over 3 kg of fresh, unabraded sherds of Bowl pottery from 25 largely unshouldered vessels, some of them heavy-rimmed and decorated in similar ways to the assemblage from the Trundle (Down and Welch 1990, 221–31). On the coastal plain to the south of the Trundle an isolated pit at Oving contained sherds from a single, plain, heavy-rimmed Bowl (Drewett 1985), and unpublished sherds eroded from the coastline at Selsey were described by Piggott as 'developed Abingdon Ware' (1954, 36).

Despite extensive wet-sieving and flotation at Bishopstone (Bell 1977, 267), no fish bones were recovered from Neolithic pits to correspond to the large quantities of edible marine molluscs, almost all mussel (Bell 1977, 284–7). Seashells from edible species were also found at Whitehawk (Ross Williamson 1930, 85; Curwen 1934a, 130; 1936, 91–2), as well as at Chalk Hill, Ramsgate, Kent (Chapter 7), where several hundred limpet shells were found with much smaller numbers of other species in a butt of one of the segments of the outer ditch (Allison 2002). This tends to reinforce the impression conveyed by stable isotope analysis (Chapter 13) that, even where marine fish would have been available, it was little consumed in this period.

Later activity on the Downs is evidenced by a pit containing Peterborough Ware which was sealed by colluvium at Malling Hill on the side of the Ouse valley, 5 km east of Offham Hill (M. Allen 1995). Farther down the Ouse, there is a stray find of a Peterborough Ware sherd from Castle Hill, Newhaven (L. Field 1939, 264–5). To the west, there is a substantial assemblage of Peterborough Ware from the topsoil of Drewett's area C on Bullock Down, Eastbourne (Drewett 1982, 49–53). A small monument at Chalkpit Lane, Lavant, on the Downs 2 km south-west of The Trundle, consisted of three concentric ring ditches with a maximum dimension of 33 m, two of them successive, dated to the later fourth to early third millennium cal BC. There were numerous red deer antlers on the base of the outer ditch and Mortlake Ware sherds and a fragmentary edge-ground discoidal knife in the fill of the second or third ditch (Magilton 1998; D. Field 2008).

Successive finds of Peterborough Ware in a quarry in the Greensand at Selmeston, on the south side of the Weald (Clark 1934b, 138–40; Drewett 1975b), point to

later fourth millennium activity off the Chalk, as does Peterborough Ware from Selsey farther west (White 1934, 41–2). Two linear projects have provided transects adjacent to causewayed enclosures: the Brighton Bypass along the South Downs north of Whitehawk (Rudling 2002) and the Westhampnett Bypass along the coastal plain south of The Trundle (Fitzpatrick 1997; Fitzpatrick *et al.* 2008). In both cases there was substantial evidence for Mesolithic and for late Neolithic/early Bronze Age activity and little for an early Neolithic presence. Westhampnett yielded sherds of a single plain Bowl from a possible palaeosol, which also contained later material, and a small amount of early Neolithic lithics, as well as a minute amount of Peterborough Ware (Fitzpatrick *et al.* 2008, 91, 104–5, 108–10). This may, however, simply reflect the generally more extensive character of Mesolithic and late Neolithic artefact scatters.

Flint mines

Investigation of flint mines in Sussex began in the nineteenth century, most notably with Pitt Rivers' excavations at Cissbury (Lane Fox 1876), and continued through the twentieth, especially its earlier part (Russell 2001b). Samples from Blackpatch, Cissbury, Church Hill and Harrow Hill were dated in the late 1960s in the course of the British Museum's flint analysis programme, which aimed to characterise the material extracted at known mine and quarry sites (Table 5.7: BM-181–5, -290; H. Barker *et al.* 1969b). These samples were all antler picks from older excavations and were prepared (Barker and Mackey 1960; H. Barker *et al*. 1971), combusted (H. Barker *et al*. 1969a), and converted to benzene (Noakes *et al*. 1965) prior to measurement by LSC (H. Barker *et al*. 1969b). Given the pretreatment used for the dating of these samples, the results are likely to be at least broadly accurate, although they have large standard deviations. In the 1980s new investigations gave rise to further dates. Excavation of a complex of interconnected shafts and galleries at Harrow Hill (McNabb *et al.* 1996) yielded one series (Table 5.7: BM-2071R, -2075R, -2097R, -2099R, -2098R, -2124R). These samples were pretreated with dilute acid and alkali and measured by LSC, as described by Burleigh *et al.* (1976). The results were recalculated following the identification of a systematic error in British Museum radiocarbon measurements issued during the period between 1980 and 1984 (Bowman *et al.* 1990). Evaluation of the top of a shaft and its surrounding area at Long Down (Holgate 1995b) provided four samples (Table 5.7: OxA-1063, -1088, -1151–2). These were prepared and measured by AMS as described by Gillespie *et al.* (1984b; 1985). Finally, four further samples from nineteenth or early twentieth century excavations at Cissbury and Harrow Hill (Table 5.7: BM-3082, -3084–6) were submitted as a result of re-examination of these archives in the course of a survey of British flint mines (M. Barber *et al.* 1999, 82) and were prepared and measured as described by Ambers and Bowman (2003). All these dates are listed in Table 5.7, and shown in Fig. 5.33.

Flint mines have certain characteristics which make it possible to be reasonably confident of an antler pick's relation to their working, even when that sample derives from an old excavation, the records of which are absent or scant. The shafts were dug and worked with antler picks, large numbers of which were recovered from them; and, with rare exceptions, the shafts were backfilled with clean chalk rubble before any appreciable weathering or silting had taken place, although backfilling did not necessarily completely fill the shaft. It is possible to envisage the sinking, working and backfilling of a shaft as the tasks of a single season (Mercer 1981b, 28–32).

In these circumstances, an antler pick from a flint mine, especially if it is recorded as coming from a gallery or from on or near the base of a shaft, probably derives from a period of activity lasting no more than a few months. The contextual integrity of charcoal samples is less easy to assess. Without a functional link with the extraction process, it is possible that already old charcoal present on the surface or in the topsoil may have been introduced into the shaft during backfilling. Given the quantity of material required for conventional dating, however, these samples may well have derived from discrete episodes of burning within the shafts. In any case, many of the charcoal samples are unidentified and only provide *termini post quos* for their contexts. It is important to remember that only a small proportion of the scores of shafts at each extraction complex have been investigated, and an even smaller proportion dated, so that the results may not be representative of the use-lives of these sites.

The dates from Harrow Hill are shown in Fig. 5.33 as part of the overall model for the early Neolithic in Sussex. A second chronological model for the use of the Harrow Hill flint mines alone is shown in Fig. 5.34. Six samples have been dated from a complex of interconnected shafts investigated in 1982 and three from older excavations. All the antler samples (Table 5.7: BM-182, -2099R, -3084–5) came from shaft bases or galleries and, if they are treated as relating to the working of the shafts, the model has good overall agreement (A=111.6%). Two of the bulk charcoal samples (Fig. 5.34: *Corylus*) came from a single find, which must have been a fairly substantial deposit if two samples could be extracted from it. It was furthermore entirely of one short-lived species and was only 0.05 m above the base of the shaft, suggesting that it was generated during extraction rather than introduced during backfilling. Both measurements are statistically consistent (T'=0.5; T'(5%)=3.8; ν=1) and their mean is in good agreement with the model. Three further bulk charcoal samples (Fig. 5.34: *BM-2097R, -2098R*, *-2124R*) were all of unidentified charcoal and came from uncertain or higher positions in the shaft fill. They are treated as *termini post quos* for the shafts because they could have contained material of diverse ages and could have been introduced from their original contexts during backfilling, although BM-2124 is, in fact, statistically consistent with the two hazel samples from the same shaft (T'=1.1; T'(5%)=6.0; ν=2). The model indicates that the shafts from which samples have been dated at

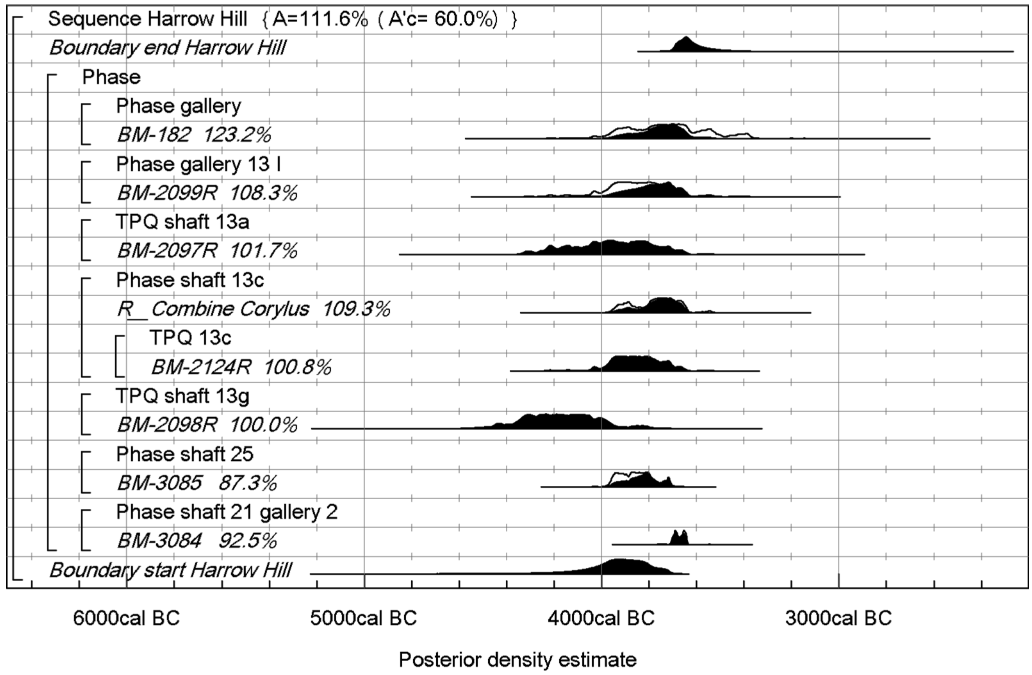


Fig. 5.34. Harrow Hill flint mines. Probability distributions of dates. The format is the same as for Fig. 5.4. The square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Harrow Hill were worked between *4250–3705 cal BC* (*95% probability*; Fig. 5.34: *start Harrow Hill*), probably *4020–3785 cal BC* (*68% probability*), and *3750–3395 cal BC* (*95% probability*; Fig. 5.34: *end Harrow Hill*), probably *3695–3580 cal BC* (*68% probability*).

The dates from Cissbury are also given in Fig. 5.33 as part of the overall model for the early Neolithic in Sussex. Another chronological model for the use of the Cissbury flint mines alone is shown in Fig. 5.35. Four whole or fragmentary antler implements (Fig. 5.35: *BM-183–5, -3082*) and an unidentified animal bone sample (Fig. 5.35: *BM-3086*) were dated from contexts directly associated with flint extraction. The measurement made on the last of these, although lacking functional association, is included in the model because it was from the base of a shaft and is in good agreement with this stratigraphic position. The model suggests – imprecisely – that the dated shafts at Cissbury were worked between *4600–3705 cal BC* (*95% probability*; Fig. 5.35: *start Cissbury*), probably *4120–3795 cal BC* (*68% probability*), and *3595–2635 cal BC* (*95% probability*; Fig. 5.35: *end Cissbury*), probably *3495–3075 cal BC* (*68% probability*).

At Long Down, no samples have been dated from galleries or shaft floors, the available measurements having been made on samples from the upper fill of a shaft encountered during an evaluation (Holgate 1995b, 350–2). Two, measured on probable mining tools (Fig. 5.33: *OxA-1151–2*), fall in the early to mid-fourth millennium cal BC, and a further two, measured on short-life charcoal, fall in the mid-second millennium cal BC (Table 5.7: OxA-1063, -1088). Pending full publication of the excavation, it can only be conjectured that the deposit incorporated material from two phases of activity at the site, and that the antler pick fragment (Fig. 5.33: *OxA-1151*) and the cattle scapula, also possibly a digging tool (Fig. 5.33: *OxA-1152*) may date from the period of mining, while the charcoal dates relate to later activity.

Only single measurements are available for antler picks from Blackpatch (Fig. 5.33; *BM-290*) and Church Hill (Fig. 5.33: *BM-181*).

The scant tally of pottery from mining contexts may include a fragment of a plain, light-rimmed, open shouldered Bowl recovered by Lane Fox (later Pitt Rivers) from a shaft at Cissbury (M. Barber *et al.* 1999, 69, fig. 5.13). The sometimes decorated, heavier-rimmed forms which characterise the enclosures seem to be absent. An early fourth millennium start for flint extraction in Sussex would be compatible with the attribution to a South Downs source of a flaked axehead (Craddock *et al.* 1983, sample no. 362) from the Sweet Track in the Somerset Levels, the construction of which is dated by dendrochronology to the end of the 39th century BC (Coles and Coles 1986; Hillam *et al*. 1990). The axehead itself (Coles and Coles 1986, pl. 28) is compatible with the 'Cissbury axe' form of those made at the mine sites (Holgate 1995c, fig. 12: 3–7; M. Barber *et al.* 1999, fig. 2.6). The same is true of some of the axeheads, flaked or ground, from the Sussex enclosures. There are examples from Whitehawk (Ross Williamson 1930, pl. XIII; Curwen 1936, fig. 320) and Bury Hill (Bedwin 1981, fig. 5), as well as the cache of three ground axeheads from Combe Hill (Drewett 1994, fig. 12). Four axeheads from Whitehawk have actually been attributed to South Downs sources by trace element analysis (Craddock *et al.* 1983, sample nos 699, 700, 703, 713). This tallies with the overlap between the use-lives of the mines and the enclosures.

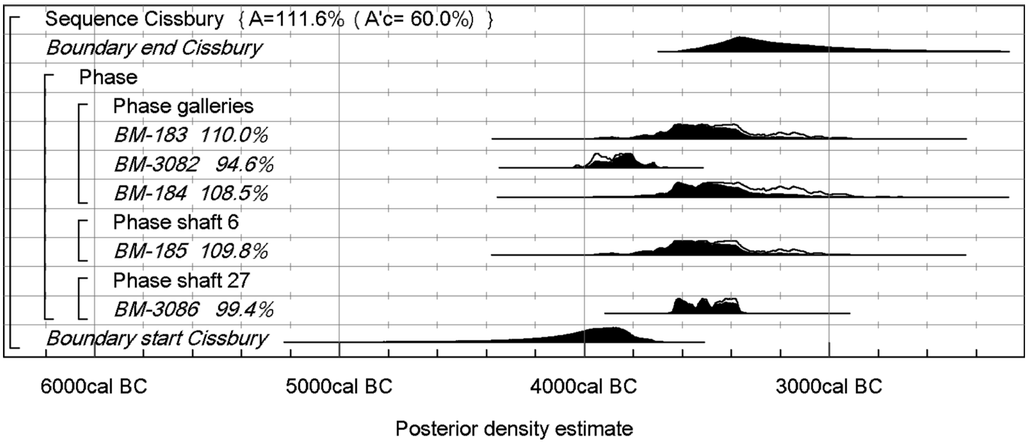


Fig. 5.35. Cissbury flint mines. Probability distributions of dates. The format is the same as for Fig. 5.4. The square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

The overall model

The overall model for the chronology of early Neolithic activity in Sussex, defined in Figs 5.32–3, suggests that new practices began here in *4065–3815 cal BC* (*95% probability*; Fig. 5.32: *start Sussex Neolithic*), probably in *3990–3855 cal BC* (*68% probability*). This phase of activity ended in *3625–3420 cal BC* (*95% probability*; Fig. 5.32: *end Sussex Neolithic*), probably in *3585–3490 cal BC* (*68% probability*).

Estimates for the start of the Neolithic in Sussex and the first dated enclosure in Sussex are shown in Fig. 5.36. It is *more than 99% probable* that there was a Neolithic presence in this region before enclosures were built. By calculating the difference between these estimates, we can suggest that Neolithic activity began *85–380 years* earlier (*95% probability*; Fig. 5.37: *Sussex initial Neolithic*), probably *150–295 years* earlier (*68% probability*), than the enclosures. This estimate for the start of the Neolithic in Sussex, probably in the 40th century cal BC, is largely based on dates from flint mines. It is similar to that for the transition to the Neolithic in Wessex provided by the Fir Tree Field shaft (Chapter 4; Fig. 4.21). It is much later than the start of Russell's primary phase of monument building, which was based on dates for samples now seen as potentially redeposited or otherwise unreliable at The Trundle (Fig. 5.22) and Court Hill (Fig. 5.28).

Mines and the settlements where those who worked the shafts must have lived preceded enclosures. The only sites with potentially early Bowl pottery so far are a mine shaft at Cissbury and a pit at New Barn Down. It may be significant that several tranchet axeheads of Mesolithic type, most of them in the same condition as the struck flint from mining contexts, were found at the Cissbury mines, although none were securely stratified (Gardiner 2001; and pers. comm.). The sinking of deep shafts with radiating galleries probably reflects techniques and expertise already established in adjacent parts of north-west Europe.

Although the chronology of flint mining in those areas is not fully established, it is clear that the methods employed in the Sussex were already developed there by the late fifth millennium cal BC. Flint from areas where mines were sunk, such as the Paris basin, the Maastricht region and Belgian Limburg, was transported over substantial distances during the Bandkeramik (Lech 1997, 623–30; Hauzeur 2006; Zimmermann 2006a; Demoule 2007a), at a time when narrow shafts were already being worked farther east at Arnhofen in Bavaria (Eisele *et al.* 2003), but convincing evidence for systematic deep extraction closer to the Channel coast so far seems more recent. The presence of Michelsberg pottery in at least part of the mining period at Spiennes in Hainaut has long been recognised (e.g. Verheyleweghen 1966, 535; de Laet 1982, 107) and corresponds to the widespread occurrence of Rijckholt- and Spiennes-type flint in Michelsberg, TRB and Vlaardingen-Stein-Wartburg contexts (de Grooth 1997; Lech 1997, 622). The radiocarbon dates which we have been able to find for those mining complexes which had begun to be worked by the early fourth millennium cal BC are listed in Table 5.8. Those which relate to the early use of these mines are modelled in Figs 5.38–40. Some measurements relating to later working are also included in the Table.

Most of the radiocarbon results from potentially early mining contexts were measured on bulk samples of unidentified charcoal and can therefore be treated only as *termini post quos* for extraction. The two measurements from Etaples, near Boulogne (Fig. 15.39: *Gif-3701, Gif-4024*), sometimes cited as relating to early extraction, fall into this category. Furthermore, while they probably relate to industrial activity, the site itself has only small, simple extraction features and the samples themselves came from pits which may relate to settlement (Hurtrelle and Piningre 1978; Piningre *et al.* 1991). There are, however, a handful of measurements, most with large standard deviations and made some time ago, on antler mining implements, which can reasonably be taken as coeval with extraction. The samples in question are picks from on or near the bases of shafts at Bretteville-le-Rabet, Calvados (Fig. 5.39: *Ly-3680*; Desloges 1986); Petit Spiennes, Hainaut (Fig. 5.40: *Lv-1566*; Gosselin 1986) and Mesvin, Hainaut (Fig. 5.40: *BM-417*; H. Barker *et al.* 1971). To these may

Table 5.8. Radiocarbon dates from flint mines in north-west France and the Low Countries. Posterior density estimates derive from the model defined in Figs 5.38–40.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
Jablines, Seine-et-Marne							
Gif-5834		Charcoal (unidentified)	2. Extraction feature 2, intersecting with shaft 11 in trench to north of main excavated area (Bulard *et al.* 1986, 57–61, 69; Pazdur 1992)	4380±110		3370–2700	
Gif-5836		Charcoal (unidentified)	7. Extraction feature 7 in trench to north of main excavated area (Bulard *et al.* 1986, 62, 69; Pazdur 1992)	4480±110		3520–2890	
Gif-5835		Charcoal (unidentified)	11. Mine shaft 11, intersecting with extraction feature 2 in trench to north of main excavated area (Bulard *et al.* 1986, 57–61, 69)	4400±300		3790–2200	
Gd-4673		Charcoal (unidentified)	12. Chambered mine shaft 12 (Bostyn and Lanchon 1992, fig. 35; Pazdur 1992)	4960±110		3980–3520	*3990–3620*
Gd-6361		Charcoal (unidentified)	14. Shallow, chambered mine shaft 14 (Bostyn and Lanchon 1992, figs 35, 39; Pazdur 1992)	4910±90		3950–3520	*3955–3620*
Gd-4674		Charcoal (unidentified)	18. Shallow, chambered mine shaft 18 (Bostyn and Lanchon 1992, 217, fig. 35; Pazdur 1992)	6140±150		5470–4710	
Gif-8411		Charcoal (unidentified)	145. Bell-shaped mine shaft 145	4840±50		3710–3520	*3760–3740* (*2%*) or *3715–3615* (*79%*) or *3610–3530* (*14%*)
Gd-6337		Charcoal (unidentified)	148. Surface debitage concentration 148, overlying at least 1 backfilled mine shaft (Bostyn and Lanchon 1992, 217, 141–6, figs 1, 130–6; Pazdur 1992)	5120±80		4060–3700	*4160–4130* (*1%*) or *4065–3705* (*94%*)
Gd-5810		Charcoal (unidentified)	246. Bell-shaped mine shaft 246 (Bostyn and Lanchon 1992, fig. 42; Pazdur 1992)	4980±60		3960–3640	*3945–3830* (*25%*) or *3825–3650* (*70%*)
Gif-8410		Charcoal (unidentified)	250. Bell-shaped mine shaft 250	4950±70		3950–3630	*3945–3855* (*17%*) or *3845–3830* (*1%*) or *3825–3635* (*77%*)
Gd-5811		Charcoal (unidentified)	332. Mine shaft 332 (Bostyn and Lanchon 1992, fig. 53; Pazdur 1992)	5030±60		3970–3660	*3965–3695*
Gd-5808		Charcoal (unidentified)	574. Galleried mine shaft 574	5130±60		4050–3780	*4050–3775*
Gd-5809		Charcoal (unidentified)	580. Galleried mine shaft 580	5120±50		4040–3790	*4040–4015* (*3%*) or *4000–3790* (*92%*)
Gd-4646		Charcoal (unidentified	735. Galleried mine shaft 735	4890±80		3930–3520	*3940–3855* (*8%*), *3815–3615* (*82%*) or *3605–3535* (*5%*)
Gd-5812		Charcoal (unidentified)	894. Galleried mine shaft 894 (Bostyn and Lanchon 1992, 217, fig. 62; Pazdur 1992)	7010±60		6020–5740	
Gd-6344		Charcoal (unidentified)	929. Galleried mine shaft 929 (Bostyn and Lanchon 1992, figs 54, 63; Pazdur 1992)	5040±80		3990–3650	*3975–3660*
Gd-6343		Charcoal (unidentified)	944 gal. 3. Gallery 3 in mine shaft 944 (Bostyn and Lanchon 1992, 217, fig. 57; Pazdur 1992)	5220±80		4260–3800	*4320–4290* (*1%*) or *4265–3935* (*94%*)
Gd-6345		Charcoal (unidentified)	944-II. Final filling of galleried mine shaft 944 (Bostyn and Lanchon 1992, 217, fig. 57; Pazdur 1992)	5150±90		4230–3710	*4080–3705*
Gd-5817		Charcoal (unidentified)	947-XIV. Layer *c.* 1 m above base of galleried mine shaft 947 (Bostyn and Lanchon 1992, 217, figs 58, 59; Pazdur 1992)	6500±60		5610–5340	
Gd-6338		Charcoal (unidentified)	947-II. Layer *c.* 3 m above base of galleried mine shaft 947 (Bostyn and Lanchon 1992, 217, figs 58, 59; Pazdur 1992)	5040±90		4040–3640	*3990–3650*
Gd-4640		Charcoal (unidentified)	1061. Galleried mine shaft 1061 (Bostyn and Lanchon 1992, fig. 69; Pazdur 1992)	5210±90		4320–3790	*4260–3795*
Gd-4675		Charcoal (unidentified)	1063. Bell-shaped mine shaft 1063 (Bostyn and Lanchon 1992, fig. 42; Pazdur 1992)	8150±130		7520–6690	

Gd-4663		Charcoal (unidentified)	1111 gal. 2. Gallery 2 in mine shaft 1111 (Bostyn and Lanchon 1992, 217, figs. 68, 70; Pazdur 1992)	5220±140		4350–3700	*4335–3795*
Gd-6349		Charcoal (unidentified)	1111-XIV. Lens of earthy silt *c.* 5 m above base of galleried mine shaft 1111 (Bostyn and Lanchon 1992, 217, fig. 68; Pazdur 1992)	4990±90		3980–3630	*3955–3645*
Bretteville-le-Rabet, Calvados							
Ly-3680		Antler implement	Shaft 9, La Fordelle. Base of backfill of galleried mine shaft 9 (Desloges 1986, 98, figs 3, 5; 1990, 170; Tarrête 1989, 142; Piningre *et al*. 1991, 130)	5560±190		4830–3970	*4715–3965*
Sablins, Etaples, Pas-de-Calais							
Gif-4024		Charcoal (unidentified)	Square B IV c1. Pit excavated in 1975 in first phase of occupation at a site with extensive working floors and small ?extraction pits. Some pottery of Cerny and Villeneuve-Saint-Germain affinities (Hurtrelle and Piningre 1978, 85; Piningre *et al*. 1991, 130)	5690±120		4800–4330	*4805–4325*
Gif-3701		Charcoal (unidentified)	Square D II b1. Pit excavated in 1976 in first phase of occupation at a site with extensive working floors and small ?extraction pits. Some pottery of Cerny and Villeneuve-Saint-Germain affinities (Hurtrelle and Piningre 1978, 85; Piningre *et al*. 1991, 130)	5660±120		4790–4260	*4790–4320* (*94%*) or *4290–4265* (*1%*)
Camp à Cayaux, Spiennes, Hainaut							
GrN-4674		Charcoal (unidentified)	Hearth 2431[b] (Vogel and Waterbolk 1967, 132)	5420±75		4450–4040	*4445–4420* (*2%*) or *4375–4045* (*93%*)
BM-289	1960, 2.63	Antler pick	Surface working floor at top of mine shaft, collected in mid nineteenth century (H. Barker *et al.* 1971, 158)	4230±130		3330–2470	
Petit Spiennes, Spiennes, Hainaut							
Lv-1598[1]		Domestic pig skull	Fill of shaft 53.2, about 5 m deep (Gosselin 1986)	5100±65		4040–3710	*4040–4015* (*2%*) or *4000–3755* (*90%*) or *3745–3710* (*3%*)
Lv-1599[1]		Bulk sample of antler fragments, described as artefacts	Fill of shaft 80.4, between 2 and 4 m deep (Gosselin 1986, 151)	4490±100		3510–2900	
Un-named		Several bones from the same human left foot, probably male	Base of fill of shaft 79.1, about 5 m deep. Date described as unpublished (Desterbecq 2005)	5100±50		3990–3770	*3990–3770*
Lv-1566		'Rake' made from distal part of an elk antler (Gosselin 1986, 110–3, fig. 41:1)	Floor of gallery E10, opening from base of shaft 79.3, 9.75 m deep. (Gosselin 1986, 151, figs 8–9)	5510±55		4460–4250	*4460–4255*
Beta-110683		Human bone	Mining feature (Collet *et al.* 2001)	4500±50		3370–3020	
OxA-3196	Strepy C	Human ribs	Poorly documented Neolithic context, discovered 1867 (R. Hedges *et al.* 1993, 151; Collet *et al.* 2001)	4830±80	−21.8	3780–3370	*3800–3520*
Sans Pareil, Mesvin, Hainaut							
BM-417	2, P.1, Base N	Antler pick	Excavated 1957 from base of shaft 1, depth 4.2 m (H. Barker *et al.* 1971, 158; Hubert 1980)	5131±123		4250–3650	*4235–3690* (*94%*) or *3685–3660* (*1%*)
Lv-216[1]		Charcoal (unidentified)	Excavated 1957 from under a large flint nodule still partly embedded in chalk in north gallery of shaft 1, depth 3.30 m (Gilot *et al.* 1966, 253)	5340±150		4460–3790	*4460–3890* (*91%*) or *3885–3795* (*4%*)
Lv-65[1]		Charcoal (unidentified)	Excavated 1957 from fill of shaft 1, depth 3.65 m (Deumer *et al.* 1964, 165)	5220±170		4370–3650	*4355–3690*
Rijckholt, Limburg							
GrN-5549		Charcoal (unidentified)	Basal fill of shaft R9 (Vogel and Waterbolk 1972, 83)	5000±40	−25.2	3950–3660	*3945–3690*
GrN-4544		Charcoal (unidentified)	Basal part of gravel and chalk fill of shaft 3 (Vogel and Waterbolk 1967, 124)	5070±60	−25.4	3990–3700	*3975–3710*
GrN-5962		Charcoal (unidentified)	Basal fill of shaft 9 (Burleigh 1976, 91)	5090±40		3980–3780	*3970–3790*

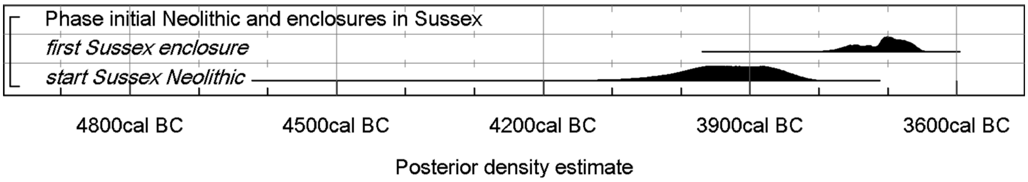


Fig. 5.36. Sussex. Probability distributions for the start of the local Neolithic (derived from the model defined in Figs 5.32–3) and for the first dated enclosure in Sussex (derived from the model defined in Fig. 5.31).

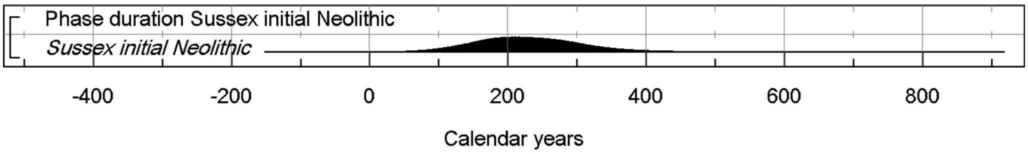


Fig. 5.37. Sussex. Number of years between the start of the Neolithic and the first dated enclosure, derived by calculating the difference between the distributions shown in Fig. 5.36.

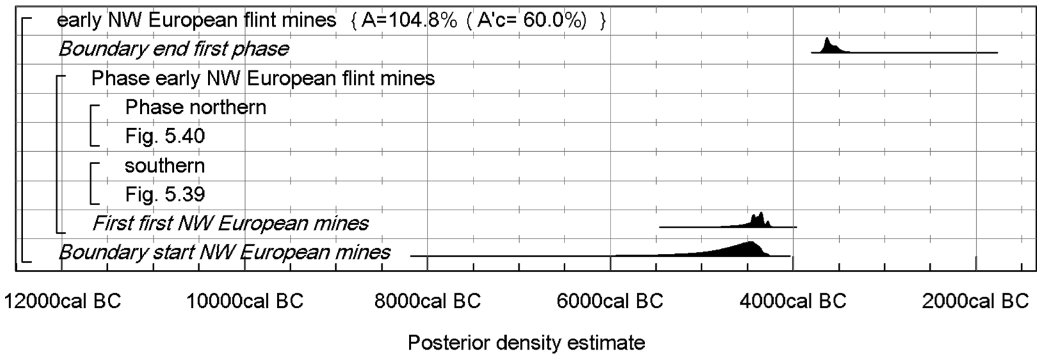


Fig. 5.38. North-west European flint mines. Overall structure of the chronological model. The format is identical to that of Fig. 5.4. The component sections of this model are shown in detail in Figs 5.39−40. The large square brackets down the left-hand side of Figs 5.38−40, along with the OxCal keywords, define the overall model exactly.

be added a measurement on bones from the same human foot from the base of the fill of a shaft at Petit Spiennes (Fig. 5.40: *un-named*; Desterbeq 2005), since they are unlikely to have been long out of articulation when buried. The estimate *first NW European flint mines* (Fig. 5.38) is effectively based on these four dates, and is correspondingly broad at *4685–4250 cal BC* (*95% probability*), probably *4465–4320 cal BC* (*64% probability*) or *4290–4265 cal BC* (*4% probability*).[2]

By far the largest series of measurements comes from Jablines, Seine-et-Marne, three from a small trial excavation (Table 5.8: Gif-5834 -5836, -5835; Bulard *et al.* 1986) and 21 from the main excavated area 100 m to the south, where activity was earlier (Bostyn and Lanchon 1992; Pazdur 1992). These call for comment. All were made on unidentified bulk charcoal samples which were probably dominated by oak, since this was by far the commonest species among the identified charcoal (Bostyn and Lanchon 1992, 51–5). Furthermore, the fact that layers are specified for only a minority (Table 5.8) suggests that most may have been bulked from more than one context within a shaft. Four results falling in the sixth millennium cal BC or earlier (Table 5.8: Gd-4674, -4675, -5812, -5817) are viewed by the excavators as aberrant (Bostyn and Lanchon 1992, 217). They may reflect earlier activity on the site and raise the possibility that charcoal from such activity may have been included in some of the other samples. For all these reasons, the dates from Jablines are treated as *termini post quos* in Fig. 5.39. Nonetheless, there are indications that the series may indeed reflect the period during which this part of the complex was worked. In the two cases where one sample was stratified above another, the pairs of dates are in good agreement with the stratigraphic relationship (Fig. 5.39: *Gd-6343* and *Gd-6345*; *Gd-4663* and *Gd-6349*). Furthermore, as the excavators point out (Bostyn and Lanchon 1992, fig. 214; Pazdur 1992, fig. 2), the dates tend to increase in age over a distance of nearly 400 m, from shaft 12 in the north-west to shaft 1111 in the south-east (this is the order in which they are arranged in Fig. 5.39). Small, abraded Cerny sherds, most of them from runs of earthy silt in the upper fills of mine shafts, could indicate a Cerny origin for the mining in a still-unexcavated area where the outcropping flint seams would have been visible. Otherwise, an even smaller quantity of later sherds, attributable to local middle Neolithic II (epi-Rössen and early Chassey-Michelsberg) seem to be contemporary with extraction in the excavated area (Bostyn and Lanchon 1992, 126–9, 216–17; 1997).

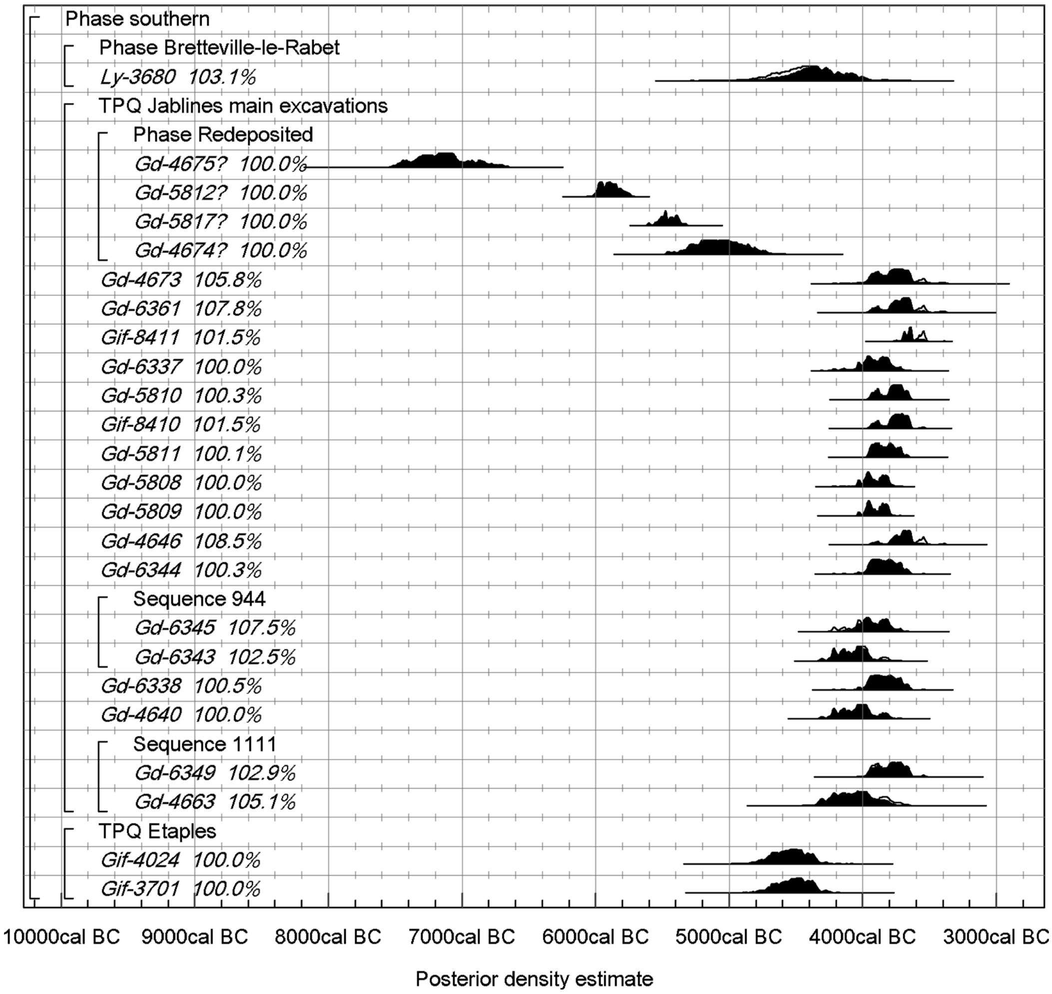


Fig. 5.39. North-west European flint mines. Probability distributions of dates for the initial phases of working of sites in France. The format is identical to that for Fig. 5.4. The overall structure of this model is shown in Fig. 5.38, and the other component in Fig. 5.40.

Flint mining emerges as one of the potentially earliest Neolithic innovations in south-east England. It is notably localised. In the fourth millennium, flint mines like those of the South Downs occupied a far smaller area than that where flint could be mined, and it was unnecessary to mine flint for the manufacture of axeheads or indeed other flint tools. Indeed most later Neolithic axeheads from Sussex were made on nodules from the same superficial sources as the rest of the collections in which they occur (Gardiner 1990). Flint mines were concentrated in central and west Sussex, barely extending westward across the Hampshire-Wiltshire border, with known examples at Martin's Clump in Hampshire and at Easton Down in east Wiltshire (M. Barber *et al.* 1999, fig. 1.1). Antler picks from a shaft at Easton Down and from a shallow shaft at Martin's Clump gave dates of 3640–2770 cal BC (95% confidence; BM-190) and 4230–3780 cal BC (95% confidence; BM-3083; M. Barber *et al*. 1999, 81–2). Given the extent of archaeological investigation in Wessex, it can only be concluded that flint mines were rarely sunk there, and the East Anglian mines are much later (Ambers 1996). The extra-utilitarian aspects of flint mining – conceptual, symbolic, cosmological and other – have been emphasised persuasively by various commentators (e.g. M. Barber *et al.* 1999, 61–7, 73; Topping 2004; Edmonds 1995, 59–66), and are exemplified in the Sussex mineshafts, alongside their engagement with the earth and its properties, by among other things articulated burials and disarticulated human bone, placed deposits and engravings. The South Downs mines may have expressed the attitudes and beliefs of one particular population, while for those to the west or east there was far less motivation to delve into the chalk to extract flint at considerable effort and risk. It is worth noting too that axeheads from the Sussex mines had a significance beyond their area of production, constituting the largest single group among a total of more than 400 ground flint axeheads sampled for trace element analysis in the 1970s, regardless of whether the artefacts had been found in the south-east of England, Wessex or East Anglia (Craddock *et al.* 1983; forthcoming).

To what extent did the Sussex flint mines continue to be worked through the later fourth millennium and beyond? There was certainly continued or resumed activity at the sites, including the raising of round barrows and/or the

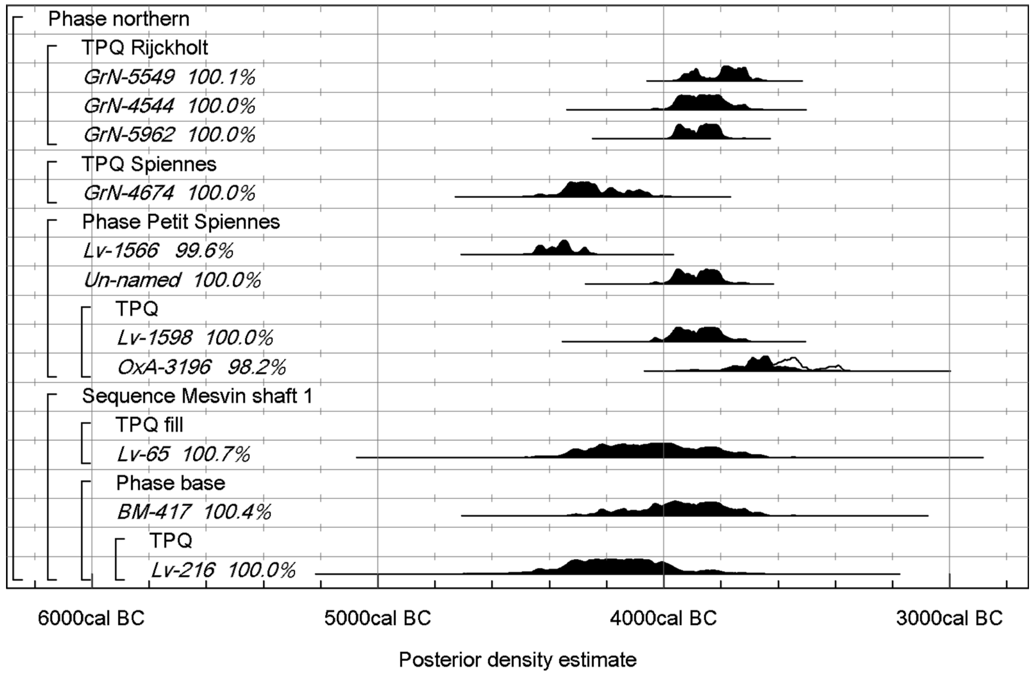


Fig. 5.40. North-west European flint mines. Probability distributions of dates for the initial phases of working at sites in Belgium and the Netherlands. The format is identical to that for Fig. 5.4. The overall structure of this model is shown in Fig. 5.38, and the other component in Fig. 5.39.

insertion of burials into existing spoil heaps, perhaps accompanied by remodelling of those heaps into more regular mounds. But it is difficult to determine, *pace* Russell (2001, 247–8), whether this included mining or consisted only of the scavenging and reworking of old spoil heaps, which could themselves have taken on the appearance of earthwork monuments (Barber 2005). Some of the burials at Blackpatch were early Bronze Age, and others were Saxon (M. Barber *et al*. 1999, 70; Russell 2001b, 48–81). An unaccompanied primary burial in barrow 12, however, must have been made when mining was still going on, unless its insertion into an existing mound was not observed, since the mound overlay one mineshaft, was overlain on one side by spoil from another, and was cut by a third (Russell 2001b, 79–81). This and the disarticulated bones scattered through the mound may have been Neolithic, as may some of the other human remains from Blackpatch (Piggott 1954, 49; Barber *et al.* 1999, 70; Russell 2001b, 48–78, 247). The nature of later Neolithic and early Bronze Age activity at the Sussex mines remains to be resolved.

Note

1 The photograph published by Oswald *et al.* (2001, fig. 8.4) as of the burial excavated by Curwen in the outer ditch of The Trundle is in fact of skeleton II in ditch III at Whitehawk (compare their figure with Curwen 1929b, pls VI and VII and Curwen 1934a, pl. XVII: 2).

2 Note added in press: see Toussaint *et al*. (2010) for a review of dates from Spiennes, which agrees with the estimates presented here.

6 Eastern England

Frances Healy, Alex Bayliss, Alasdair Whittle, Francis Pryor, Charles French, Michael J. Allen, Christopher Evans, Mark Edmonds, John Meadows and Gill Hey

The scarp of the southern Chalk runs on north-eastwards from Wessex, forming first the Chilterns and then the East Anglian Chalk ridge (Fig. 6.1). This has traditionally been seen as a route, the Icknield Way, linking eastern England with Wessex. The East Anglian Chalk Ridge borders the east side of the Fenland basin and is edged by sands, notably in the Breckland of south-west Norfolk and north-east Suffolk, and the Goodsand region of north-west Norfolk. Farther to the east the Chalk is covered by the heavy boulder clays of central East Anglia, cut by rivers draining west into the Fens and, on the other side of the mid-Anglia watershed, east into the North Sea. Bordering the North Sea are further areas of lighter soil in the form of the Suffolk Sandlings and the Coverloam of north-east Norfolk. South-west of the Fens, the landscape is dominated by expanses of Boulder Clay, the extent of which

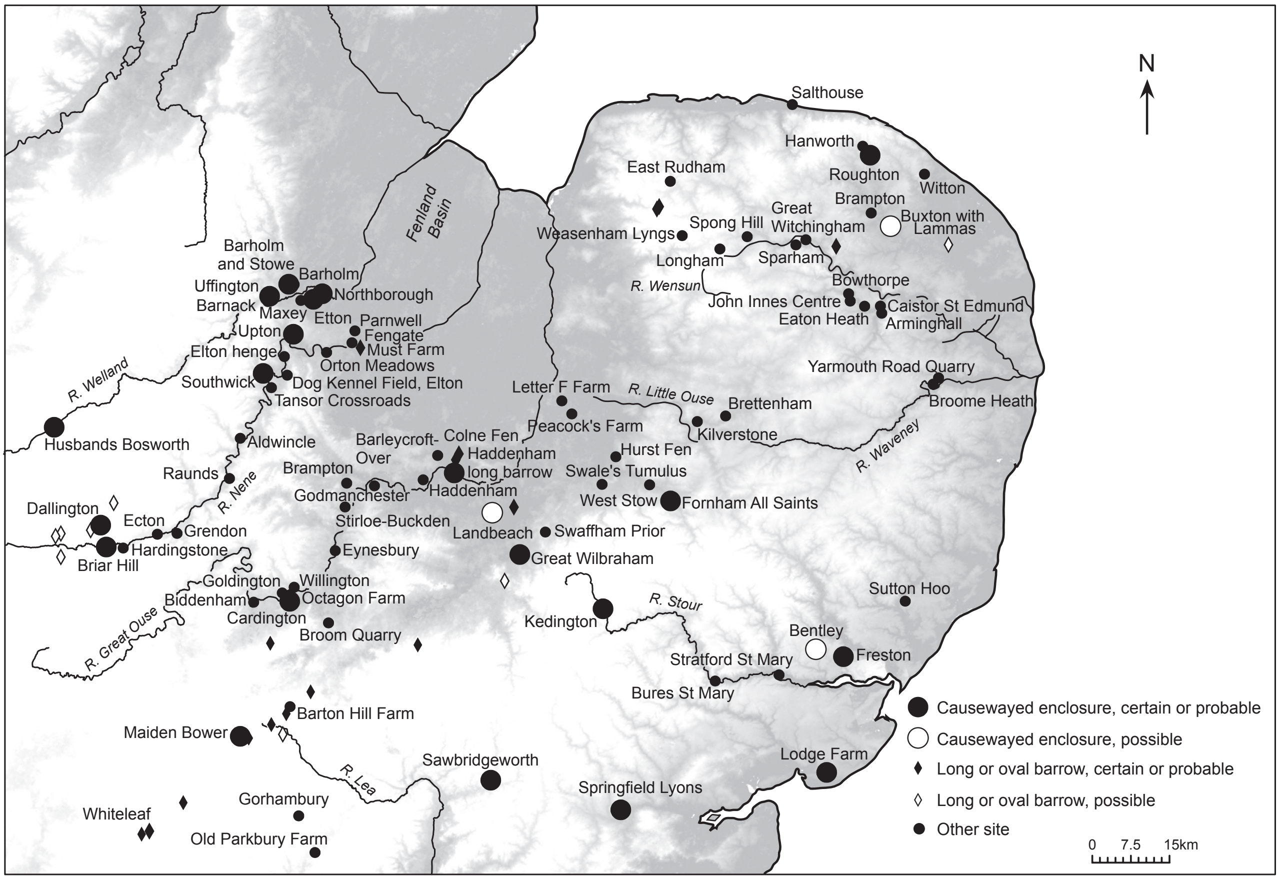


Fig. 6.1. Eastern England and the adjoining part of the Greater Thames estuary, showing causewayed enclosures, long barrows and other sites mentioned in Chapter 6.

diminishes as the limestone uplands of Northamptonshire and Lincolnshire approach the basin. Major rivers drain into the basin here: from south to north, the Great Ouse, Nene and Welland.

The different topographies of the two sides of the basin are reflected in its lithic resources. To the west, most of the flint worked was obtained from Boulder Clays and gravels and was sometimes of small size and poor quality. To the east, there was abundant, high-quality flint, not only *in situ* in the Chalk, but in secondary deposits derived from the Chalk over relatively short distances. Flint mining here does not seem to have been initiated until the third millennium cal BC, when it is most spectacularly evidenced at Grime's Graves in the Norfolk Breckland (Ambers 1996), in contrast to its early appearance on the South Downs (Chapter 5).

Like other parts of eastern England (Chapters 5 and 7), the area has lost land to rising Holocene sea levels. While the timber circle known as Seahenge, built in the spring or early summer of 2049 BC (Groves 2003), is the best known prehistoric feature in the intertidal zone, the foreshore bears evidence for occupation from the late Upper Palaeolithic onwards (Wymer and Robins 1994). Long-term sea level rise, estimated at some 15 m between 5500 cal BC and the present, and shorter-term fluctuations (I. Shennan 1994, fig. 5.24) have contributed to a complex and dynamic history for the low-lying Fenland basin at the heart of the region. At the start of the period covered by this chapter most of the southern part of the basin, including the areas of the Haddenham and Great Wilbraham enclosures, would have been dry land and largely afforested, with peat confined to river channels and other particularly low-lying areas (Waller 1994, 86–8, 182–3, figs 5.14–15, 6.1). There is exceptional palynological evidence from the channel of the Great Ouse at Haddenham for forest clearance accompanied by cereal cultivation starting shortly after 4460–3990 cal BC (Fig. 6.13; 95% confidence; 5420±100 BP; Q-2814; Peglar and Waller 1994). Peat deposits of this age are scarce, and most indicators of clearance and cultivation fall in the second millennium cal BC (Waller 1994, 105–7). This is discussed further below. Throughout the basin, a rise in sea level in the late fourth and early third millennium cal BC led to widespread saltmarsh conditions, which reached their maximum extent in the south-east in the mid-third millennium cal BC and in the west and south-west in the early second millennium (Waller 1994, figs 5.18, 5.19). Islands of slightly higher ground were repeatedly occupied. To the west and north, marine incursions have been recurrent from an earlier date, inorganic sediments are more significant and, in what is now the Peterborough area, where two major rivers, the Nene and Welland, converge on the basin, sedimentation and flow are heavily influenced by large gravel islands and peninsulas.

Changes in the basin had a profound effect on the rivers flowing into and through it, not only on rates of flow but on channel form and even course. The geomorphological history of the basin has had a major impact on the nature, priorities and history of research in the area. Its potential was formally recognised by the Fenland Research Committee founded in the inter-war period, whose members pioneered both environmental analyses of the peat deposits of the basin and realised the potential of well preserved settlement sites revealed by the erosion of deposits which had long protected them (Godwin 1978). This emphasis was sustained in the post-war period by radiocarbon dating and pollen analysis at Peacock's Farm, Shippea Hill, Cambridgeshire, first investigated in the 1930s (Clark and Godwin 1962) – an exercise repeated later in the century (A. Smith *et al.* 1989; Waller and Alderton 1994) – and by the investigation of Hurst Fen in Suffolk (J. Clark 1960), and subsequently carried further forward by the Fenland Project of 1981–8 (Hall and Coles 1994).

The area is rich in later Mesolithic sites and finds, including extensive and abundant lithic scatters, which must mark repeatedly visited locations, as well as dispersed artefacts. Repeated visits to a single site are most clearly demonstrated at Peacock's Farm, where peats in a former channel of the Little Ouse which bordered an occupied sandhill had formed from at least the eighth millennium cal BC (8230–7340 cal BC; Q-588; Table 6.4). A charcoal-rich 'black band' in the peat, incorporating material derived from later Mesolithic occupation of the ridge and originally recognised in the 1930s (Clark *et al*. 1935) proved to be made up of successive deposits, sometimes separated by other sediments. Dates on the organic contents of the 'black band' showed that it had accumulated between at least 7520–7060 cal BC (95% confidence; CAR-1100; Table 6.4) and 5880–5320 cal BC (95% confidence; Q-586; Fig. 6.18; Table 6.4), straddling two pollen zones, in the upper of which there was a local diminution of forest cover (A. Smith *et al*. 1989, 214–19, 237–46).

More restricted early Neolithic use of the Peacock's Farm ridge conforms to the widespread occurrence of material of both Mesolithic and Neolithic periods on the same sites in all parts of the region. This may be seen as the result of the use of particular places and the maintenance of specific working traditions over long periods of time, in the course of patterns of movement and routine activity which took people from one part of the landscape to another (Edmonds *et al.* 1999, 56, 71). Direct continuity is, however, difficult to demonstrate in such cases. At Peacock's Farm, indeed, there was a gap of centuries between the Mesolithic and Neolithic occupations, as there also seems to have been at Spong Hill, in mid-Norfolk (Table 6.12). At Raunds, in the Nene valley, continuity is plausible, since a concentration of late Mesolithic lithics coincides with features dated to the fifth millennium cal BC (Table 6.7: UB-3329, OxA-3057), as well as with early Neolithic occupation which preceded the construction of early fourth millennium monuments (Harding and Healy 2007).

In the Raunds area there is a contrast between the virtual restriction of diagnostically Mesolithic lithics to the bottom of the Nene valley and the wider distribution of early Neolithic material which extends up the valley sides (Harding and Healy 2007). Similarly, in the Barleycroft-Over area of the lower Great Ouse valley, Mesolithic material is almost confined to the river edges while early

Neolithic lithics are more widespread (Evans and Knight 2000, 94). The picture seems similar on the south-east edge of the basin, where, in what would have been largely an area of low-lying dry land, Mesolithic sites and finds were markedly concentrated along the then courses of the rivers Wissey and Little Ouse (in the second case extending from Shippea Hill upstream into the Breckland: Robins 1998; Healy 1996, fig. 34), while early Neolithic ones were more widely scattered (Silvester 1991, 80–2, figs 45, 46, 70, 71).

This suggests that, while common needs persisted, Neolithic lifeways entailed use of a greater variety of terrain. In addition to the river valleys throughout the region, the principal areas of Neolithic activity seem to have been the Chalk Ridge, the Coverloam of north-east Norfolk, the Sandlings of north-east Essex and south-east Suffolk, the Goodsand region of north-west Norfolk, the Breckland, and the margins and 'islands' of the fenland basin. These last are prone to over-representation, partly because they have been a focus of research, and partly because of the enhanced preservation afforded by the blanketing sediments. All these areas are already detectable on Piggott's distribution maps of the Windmill Hill culture (1954, fig. 1), but, with the exception of the results of Wyman Abbott's work at Peterborough in the early twentieth century, every site represented is on the east side of the basin. Since the 1950s, an upsurge in economic growth to the south and west of the basin has reversed the balance of investigation and information, most spectacularly by large-scale projects in the Etton-Maxey area of the Welland valley from the mid-1960s (Pryor *et al*. 1985; W. Simpson *et al*. 1993; Pryor 1998; French and Pryor 2005); at Fengate, Peterborough, on the lower Nene, starting in the late 1960s (Pryor 1974; 1978; 1980; 1984; 1993; 2001); in the Haddenham and Barleycroft-Over area of the Great Ouse valley from the 1980s (C. Evans *et al*. 1999; Evans and Knight 2000; 2001; Evans and Hodder 2006); and in the Raunds area of the Nene valley in the 1980s and 1990s (Harding and Healy 2007).

Long barrows are rare and unevenly distributed in the region (Kinnes 1992a, fig. 1A.1). Almost equally numerous are Neolithic round or oval mounds (Kinnes 1992a, fig. 1A.2), notably Whiteleaf, near Princes Risborough on the Chilterns in Buckinghamshire (Childe and Smith 1954; Hey *et al*. 2007) and several in the Nene valley in Northamptonshire and Cambridgeshire. Long barrows tend to occur on the higher ground, whether the Chilterns and the East Anglian Chalk ridge or the limestone uplands of Northamptonshire. Exceptions include two, possibly three, formerly peat-covered long barrows north of the Haddenham enclosure in the Great Ouse valley (Evans and Hodder 2006, fig. 1.1) and another at Raunds in the Nene valley (Harding and Healy 2007). More frequent in the river valleys west of the Fens are elongated enclosures and cursus monuments (Last 1999; Malim 1999; 2000).

Some causewayed enclosures in this region occur in similar low-lying valley locations, sometimes close to linear monuments, notably in the case of Cardington which lies on a slight gravel rise in the Great Ouse valley near Bedford (Oswald *et al*. 2001, fig. 4.10) in an area rich in cursus and related monuments (Malim 2000, figs 8.2, 8.13). Similarly placed are Haddenham farther down the same valley; Etton, on the gravels of the Welland valley, cut by a cursus monument; and a pair of causewayed enclosures, also cut by a cursus, at Fornham All Saints, on a rise in the floor of the Lark valley in the Suffolk Breckland (Oswald *et al*. 2001, fig. 8.2). Others are in locally elevated locations, among them Maiden Bower on the Chilterns, and Briar Hill, Dallington, Southwick and Upton, all overlooking the Nene valley.

Like other Neolithic monuments, causewayed enclosures are rare east of the Fens and north of the Stour (Fig. 6.1), and none has been excavated there. This chapter therefore focuses on the excavated enclosures of Maiden Bower, Bedfordshire; Briar Hill, Northamptonshire; Great Wilbraham and Haddenham in Cambridgeshire; and Etton, Etton Woodgate and Northborough, all part of a cluster of enclosures on the lower Welland in the same county. This cluster lies at the edge of the core distribution of causewayed enclosures, which are scarce north and north-west of the Welland (Fig. 6.1). A long history of cultivation in the region has ensured that no examples with upstanding earthworks survive. Discovery has principally been through aerial photography since 1960, as reflected by the increased numbers of sites shown successively by Piggott (1954, fig. 1), Palmer (1976a, fig. 1) and Oswald *et al*. (2001, fig. 1.1). A segmented ditched enclosure at Salthouse, in north Norfolk, suggested as a causewayed enclosure (Brennand *et al*. 2002), is not included here because its small diameter of 60 m, its area of *c*. 0.3 ha and its near-circular plan are more readily matched among henge-like monuments.

We present the area in geographical sections, starting with the Chilterns, closest and most similar to the southern Chalk. We then proceed to each of the major river catchments west of the Fens, the Great Ouse, the Nene, and the Welland, which formed corridors of diverse geology and relatively light soils through terrain much of which is covered by heavy Boulder Clay, and which were foci of both settlement and monument building (Harding and Healy 2007, chapter 5). Finally we discuss the area east of the Fens.

6.1 The Chilterns

6.1.1 Maiden Bower, Houghton Regis, Bedfordshire, SP 9966 2247

Location and topography

Maiden Bower is the name given to an Iron Age hillfort which lies at 150 m OD on a plateau overlooking the northern edge of the Chiltern scarp, just outside Dunstable. Under the hillfort and to the west of it were discovered Neolithic features which were almost certainly part of a causewayed enclosure, although little can be said of its form (Fig. 6.2). There are possible long barrows on this

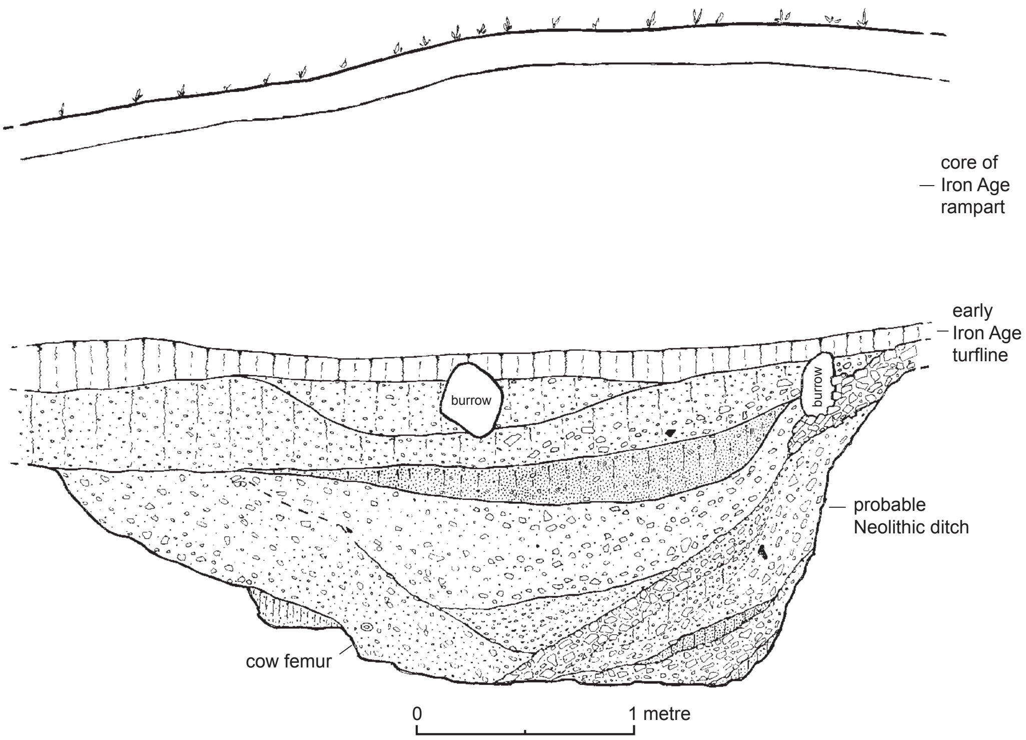


Fig. 6.2. Maiden Bower. Section of the Neolithic enclosure ditch exposed in the quarry face. After Oswald et al. *(2001, fig. 2.18).*

part of the ridge (W.G. Smith 1904a, 159–60; 2004b; N. Thomas 1964b, 25; Dyer 1964, fig. 4; Ashbee 1970, fig. 10), as well as Grooved Ware pits, round barrows and ring ditches (N. Field *et al*. 1964, 360–7; Matthews 1976, 2–8). Two successive burials, the first accompanied by a Beaker and other artefacts, were recovered from a chalk quarry at Swell, some 370 m north of the site (Matthews 1976, 19–24). 'The interior of the camp called Maiden Bower near Dunstable contains, or has contained, many stone implements and flint flakes. For a certain number of yards outside the camp the same abundance prevails, but beyond a given circuit both implements and flakes are rare' (W.G. Smith 1904a, 160). Smith noted (1915, 148) that these were almost all of flint from the Upper Chalk and must have been brought to the site, and that leaf-shaped and barbed and tanged arrowheads occurred in equal numbers amongst it.

History of investigation

From the 1890s to the early 1900s Worthington Smith observed, recorded, excavated and collected from archaeological features exposed during chalk quarrying (Fig. 6.3). Many were Iron Age or Romano-British, but others were clearly of earlier date and ascribed by him to the Bronze Age. He described these in a paper read to the Society of Antiquaries of London:

> During the very extensive excavations for chalk by Messrs. Forder & Co. on the west side of Maiden Bower, numerous discoveries of shallow pits, filled with chalk rubble, broken bones, antlers of fallow-deer, broken and cut antlers of red-deer, flints, etc., have been found. . . . two long grave-like excavations . . . were remarkable. The smaller was 25 ft. [7.2 m] long, 10 ft. [3.1 m] wide, and 4 ft. [1.2 m] deep, the larger 43 ft. [13.1 m] long, 10 ft. [3.1 m] wide, and 3 ft. [0.90 m] deep. They were excavated in 1897 and found to contain many split, root-eaten bones and broken or cut antlers of red and roe-deer. The bones, skulls and jaws were chiefly of *Bos longifrons*, red deer, horse, sheep or goat, pig and large dog. Amongst the bones were parts of a broken up human skeleton which represented an aged person, with greatly worn-down teeth. Strange to say, there was also a part of a humerus of *Bos primigenius*, white and root-eaten, a notable find . . .
>
> The long bones represented hundreds of animals that been killed and eaten; nearly all the bones were split or broken across the middle in pre-Roman times for the marrow. The bones were all rugose with age on the outer, inner and split surfaces. On close examination of the long pieces of bone and antler I was enabled to rejoin some of them and partly rebuild the original bone or antler. In these examples none of the fractured surfaces was new and smooth, all were old and rugose.' (W.G. Smith 1915, 149–50).

Smith's finds included an antler 'comb' like those found in several causewayed enclosures (W.G. Smith 1904a, 169–70, fig. 60).

The 'grave-like' features read very like segments of an enclosure ditch, and Curwen included Maiden Bower in his paper on causewayed enclosures (1930, 41). The impression

Fig. 6.3. Worthington Smith, the excavator of Maiden Bower, points out lower Palaeolithic deposits at Caddington, Bedfordshire. © Luton Museum Service.

was enhanced by the recognition of fragments of at least ten Mildenhall- or Abingdon-like Bowls in an undocumented collection from the site, held at the time in the Bedford Modern School Museum (Piggott 1931, 90–2).

Later in the twentieth century, the eroding quarry face was visited repeatedly by members of the Manshead Archaeological Society of Dunstable, led by C.L. Matthews. They recorded two further ditch segments, one of which yielded no finds and the other 'only the smallest fragments of pottery' (Matthews 1976, 1–3). A pit (pit 11) beneath the turfline sealed by the Iron Age rampart was more prolific, its surviving half containing fragments of six or more vessels comparable to those illustrated by Piggott (Matthews 1976, 8–9).

In 1991 geophysical and fieldwalking survey were undertaken by Joshua Pollard and Michael Hamilton, then research students at Cardiff University, with the primary aim of locating and defining the surviving parts of the Neolithic enclosure, while at the same time elucidating the Iron Age and Romano-British use of the site (Pollard and Hamilton 1994). Although Neolithic ditches were visible in section in the quarry face, no continuation of them could be detected by gradiometry or resistivity, prompting the conclusion that the enclosure may have lain largely or entirely outside the hillfort to the north-west, the exposed sections being almost all that remained of it. Inside the hillfort, however, a previously unrecognised enclosure, inside and concentric with the upstanding bank, was clearly detected, as were discrete anomalies. Possible interpretations range from a component of the Neolithic complex, which subsequently provided a site for the later earthwork, to an immediate precursor of the hillfort itself (Pollard and Hamilton 1994, 15–17). Fieldwalking was confined to a sample of the hillfort interior and confirmed Smith's impression that both early Neolithic and later material was present, showing that the latter was in the majority (Pollard and Hamilton 1994, 14).

In the course of a survey of the hillfort in 1994 (Barber 2004, fig. 1.3), Alastair Oswald, then of RCHME, drew the section reproduced here as Fig. 6.2. Horne's argument (1996) that the Neolithic ditches identified at Maiden Bower could have surrounded a long barrow rather than formed part of a causewayed enclosure is a reminder of how ambiguous and incomplete the evidence from the site is. On balance, however, there are several points in favour of the former presence of an enclosure. None would be convincing alone, but collectively they carry some weight: the shape and dimensions of the 'grave-like excavations' described by Smith; the sheer quantity of bone, which 'represented hundreds of animals'; the presence among it of the disarticulated remains of a human being; the antler 'comb'; the heavy-rimmed, decorated Bowl pottery and, finally, the location – if the earthwork, whatever it was, lay almost entirely in the area of the quarry rather than beneath the hillfort, then it would have 'hung' off the side of the chalk ridge facing on to the lower ground to the north-west, in the manner of many causewayed enclosures (Oswald *et al.* 2001, fig. 5.24).

Table 6.1. Radiocarbon dates from Maiden Bower, Bedfordshire. Posterior density estimates derive from the model defined in Fig. 6.4.

Laboratory Number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Ditch segments?							
OxA-15079	Wardown Park Museum 6/372/40/A	Red deer. Antler base, shed, brow and bez tine and distal end of beam recently broken off. Highly unlikely to be from same animal as the sample for GrA-29891 because it is much larger	The sole contextual evidence is in the words marked on the antler: 'Maiden Bower 99 WGS'	4866±31	−22.3	3710–3630	
GrA-29891	Wardown Park Museum 6/372/40/B	Red deer. Antler base, shed, with fairly recently broken brow tine and beam. Highly unlikely to have come from the same animal as the sample for OxA-15079 because it is much smaller	The sole contextual evidence is in the words marked on the antler: 'Maiden Bower 1900. WGS'	4710±40	−22.8	3640–3360	*3630–3560* (*18%*) or *3540–3485* (*21%*) or *3475–3370* (*56%*)
GrA-29892	Wardown Park Museum 2/372/40	Aurochs. Distal end of R femur with fitting, unfused epiphysis (glued on)	The sole contextual evidence is in the words marked on the bone: 'Femur. Bos primigen's. Maiden Bower 1.1903. WGS'	4690±40	−21.8	3640–3360	*3630–3580* (*13%*) or *3535–3370* (*82%*)
Pit 11							
GrA-30026	Wardown Park Museum A248 M321 P248/A	Red deer. Large tine with chipped, worn tip. Recently broken from beam close to ancient cut with parallel incomplete cutmarks	Pit 11. Exposed in eroding quarry face at north side of Maiden Bower hillfort, surviving to 0.92 m across and 0.46 m deep, containing Neolithic Bowl pottery, some of it decorated (Matthews 1976, 8–9)	4695±40	−22.5	3640–3360	*3630–3580* (*14%*) or *3535–3370* (*81%*)
OxA-15098	Wardown Park Museum A248 M321 P248/B	Cattle. Articulating astragalus and distal end of tibia	From the same context as GrA-30026	4735±31	−22.1	3640–3370	*3635–3555* (*25%*) or *3540–3495* (*21%*) or *3455–3375* (*49%*)

Previous dating
Up to the time of the project, dating had been stratigraphic, morphological and artefactual.

Objectives of the dating programme
It was hoped to locate suitable samples which could be assigned to contexts in the ditch segments.

Sampling strategy
Sampling was severely limited by the availability of material and by the contextual uncertainties associated with the artefacts rescued by Worthington Smith. It was only feasible at all because Worthington Smith had marked his finds in ink and at least some of them had found their way into the Wardown Park Museum, Luton. The Manshead Society had deposited their archive in the same place. Three samples corresponded to Smith's descriptions of his finds from the probable ditch segments. A proximal aurochs femur fragment not only matches his record of aurochs but is highly likely to have come from a Neolithic feature, despite Iron Age and Roman activity on the hill, because the aurochs became extinct in Britain in the course of the second millennium cal BC. Substantial fragments from two red deer antlers similarly correspond to Smith's record of many broken or cut antlers. The two remaining samples were clearly documented as coming from the pit excavated by the Manshead Society.

Results and calibration
Details of the five radiocarbon determinations are provided in Table 6.1.

Analysis and interpretation
A model for the chronology of the Neolithic activity at Maiden Bower is presented in Fig. 6.4.
The probable ditch segments. Among Smith's finds, the recovery of a proximal aurochs shaft fragment with fitting epiphysis (Fig. 6.4: *GrA-29892*), especially in salvage conditions, indicates that they were buried together and hence still joined by soft tissue, while the two antler fragments (Fig. 6.4: *GrA-29891,* OxA-15079) are substantial enough to have come from implements used to dig the features. There is no evidence of their precise contexts. GrA-29891–2 are statistically consistent ($T'=0.1$; $T'(5\%)=3.8$; $\nu=1$), but OxA-15079 is older ($T'=15.8$; $T'=(5\%)= 6.0$; $\nu=2$; Table 6.2). This could reflect derivation from successive levels in the fills, in which case OxA-15079 would be closer to the construction date than the other two measurements. Alternatively, the implement dated by OxA-15079 could already have been old when buried, while it is possible to be fairly confident that the aurochs femur with unfused fitting epiphysis was not. For this reason, OxA-15079 is excluded from the model.
Pit 11. Here a worn and cut-marked antler tine (Fig. 6.4: *GrA-30026*) had been part of an implement, possibly another pick, and two articulating bones (Fig. 6.4: *OxA-15098*) would have been fresh when buried. These results are statistically consistent with each other ($T'=0.6$; $T'(5\%)=3.8$; $\nu=1$) and with GrA-29891–2 ($T'=1.0$; $T'(5\%)=7.8$; $\nu=3$).

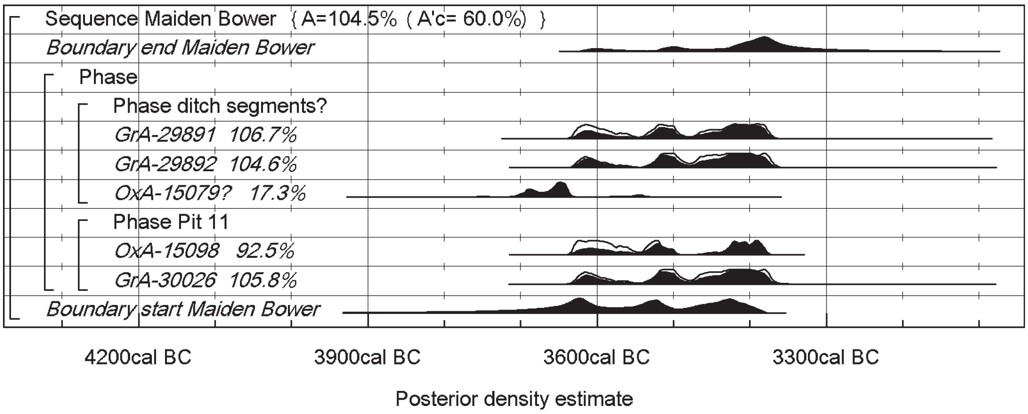


Fig. 6.4. Maiden Bower. Probability distributions of dates. Each distribution represents the relative probability that an event occurred at a particular time. For each of the dates two distributions have been plotted, one in outline which is the result produced by the scientific evidence alone, and a solid one which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution 'start Maiden Bower' is the estimated date when Neolithic activity at Maiden Bower started. Dates followed by a question mark have been calibrated (Stuiver and Reimer 1993), but not included in the chronological model for reasons explained in the text. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

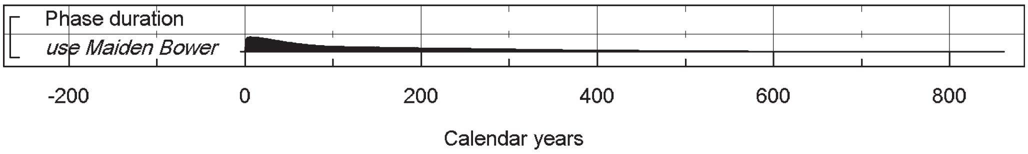


Fig. 6.5. Maiden Bower. Probability distribution of the number of years during which the Neolithic site was in use, derived from the model shown in Fig. 6.4.

Implications for the site

The limitations of the dating evidence are great. Nonetheless, the four statistically consistent measurements point to a period of use running from *3775–3380 cal BC* (*95% probability*; Fig. 6.4: *start Maiden Bower*) to *3620–3550 cal BC* (*8% probability;* Fig. 6.4: *end Maiden Bower*) or *3525–3200 cal BC* (*87% probability*), probably from *3660–3590 cal BC* (*23% probability*) or *3555–3505 cal BC* (*17% probability*) or *3475–3395 cal BC* (*28% probability*), to *3515–3480 cal BC* (*8% probability*) or *3435–3315 cal BC* (*60% probability*). This activity seems to have spanned a period of *1–480 years* (*95% probability*; Fig. 6.5: *use Maiden Bower*), probably *1–205 years* (*68% probability*), although this distribution is strongly skewed and a shorter rather than a longer duration is more probable. The estimated chronology for this site is imprecise, but, in the absence of stratigraphic control and more numerous samples, unavoidably so.

6.1.2 Implications for the Chilterns

Despite a long history of fieldwork on the Chiltern ridge, few Neolithic sites have been dated. There have been inklings that some of the round barrows are of middle or late Neolithic origin, notably barrow 5 at Five Knolls, Dunstable, which covered a primary inhumation accompanied by a ground-edged flint knife made on a blade (Dunning and Wheeler 1931; Kinnes 1979a, 16) and site I at Barton Hill Farm, Streatley, where a single-causewayed ring ditch containing Peterborough Ware surrounded a possible structure and two inhumations, one accompanied by a shale bead (Dyer 1962; Kinnes 1979a, 15). Unequivocally Neolithic is a slightly ovoid ditched mound on Whiteleaf Hill, 25 km south-west of Maiden Bower (Fig. 6.1), which was excavated in the 1930s by Sir Lindsay Scott (Childe and Smith 1954). The mound covered a probable timber chamber and may have incorporated other timber elements. Within the chamber was an articulated foot, belonging to the skeleton of a male over 50 years-old (Hey *et al*. 2007), most of whose bones were scattered in a restricted area in front of the chamber. In the core of the mound was a large assemblage of pottery of Mildenhall and Abingdon affinities (totalling nearly 11 kg), as well as lithics and animal bone. The pottery was in fresh condition and it is possible that the assemblage could have related to mound building. Reassessment of the archive and further investigation of the monument by Oxford Archaeology (Hey *et al*. 2007) has entailed the dating of three radiocarbon samples, one of human bone, one of carbonised residue from a sherd, and one of antler, in order to provide a basic chronology for the monument (Table 6.4; Fig. 6.6).

Since the disarticulated human remains were recovered from a circumscribed area and consisted of the greater part of the skeleton of one individual (Childe and Smith

1954, 216, 220), the individual was probably articulated and hence freshly dead when deposited. The presence of a timber chamber, in which a few of the bones remained, makes it possible that he was placed there some time before the mound was built. The dispersal of most of the bones in a small area in front of the chamber could, if it was not the result of animal or other post-depositional disturbance, have resulted from rearrangement of the by then defleshed skeleton before both chamber and bones were covered by the barrow. The bones appear to have been dry and brittle when moved and broken, indicating an interval between death and that event. A date for one of these bones of *3760–3740 cal BC* (*2% probability*; Fig. 6.6: *OxA-13567*) or *3715–3635 cal BC* (*93% probability*), probably of *3695–3645 cal BC* (*68% probability*), should thus relate to the construction and use of the chamber, and provides a *terminus post quem* for the building of the mound.

The material incorporated in the inner mound should, like the skeleton, pre-date mound construction, if only by a matter of days or hours. A date for carbonised residue on a sherd from this assemblage of *3655–3615 cal BC* (*27% probability*; Fig. 6.6: *NZA-21036*) or *3610–3520 cal BC* (*68% probability*), probably of *3645–3625 cal BC* (*18% probability*) or *3585–3530 cal BC* (*50% probability*), is thus also a *terminus post quem* for initial mound building.

An interval between the burial and the raising of the mound is indicated by an estimated difference between *OxA-13567* (the skeleton) and *NZA-21036* (the residue) of *1–180* years (*95% probability*), probably *40–150* years (*68% probability*; distribution not shown).

The weathered condition of the antler from the upper part of the mound makes it impossible to judge whether it was a digging implement. If it was such, it should be close in age to a subsequent modification otherwise evidenced in the ditch. If not, it provides a *terminus post quem* for its context. In the first case, the modification would have taken place in *3365–3260 cal BC* (*50% probability*; Fig. 6.6: *NZA-20964*) or *3245–3110 cal BC* (*45% probability*), probably in *3365–3315 cal BC* (*36% probability*) or *3275–3265 cal BC* (*1% probability*) or *3230–3180 cal BC* (*21% probability*) or *3160–3130 cal BC* (*10% probability*). In the second case, it would have taken place in or after this date.

The date when the mound was built is bracketed by *NZA-21036* and *-20964*. The interval between them is so great that it can be estimated only very approximately: *3620–3200 cal BC* (*95% probability*; Fig. 6.6: *build mound*), probably *3555–3335 cal BC* (*68% probability*).

Neither the enclosure at Maiden Bower nor the barrow at Whiteleaf can be considered to be securely dated. On the available evidence, however, the mortuary structure at Whiteleaf may have been constructed before the Maiden Bower enclosure (*85% probable*). Whiteleaf seems to have witnessed prolonged, although possibly episodic, activity, over a number of centuries, which continued after the use of the enclosure (Fig. 6.6). In contrast, the use of the enclosure may have extended across no more than a generation or two (Fig. 6.5).

On the dip slope of the Chilterns, at Gorhambury, some 20 km south-east of Maiden Bower (Fig. 6.1), there is a structure of a kind rare in south-eastern England. A slot-defined rectangular building 7 m wide and over 9 m long, with a transverse internal division seems, on the evidence of charcoal and burnt daub in the slots, to have burnt down. The slots also contained a small quantity of plain Bowl pottery and lithics, including blades (Neal *et al.* 1990, 7–9, 175–6; 218–21). A bulk sample of oak charcoal from one slot provides a *terminus post quem* of 3760–3380 cal BC (95% confidence; HAR-3484; Table 6.4). A further 7 km south of Gorhambury, at Old Parkbury Farm, Colney Street, on a gravel terrace of the Colne (Fig. 6.1), were found the traces of a hollowed out oak trunk, burnt *in situ* and surviving as charcoal and burnt sand in an elongated ovoid pit, the trunk itself measuring 5.30 m by 1.00 m. At one point within it were the cremated remains of an adult and at least one small mammal. Other finds, not directly associated with the bones, were three flint flakes, a charred hazelnut shell fragment, two indeterminate charred cereal grains and four other charred seeds (Niblett 2001, 157–62, 182). The excavator interpreted the trunk as a logboat, because one end was rounded and the other pointed. It might equally be seen as a variant on linear burial structures like F5352 at Barrow Hills, Radley, Oxfordshire (Chapter 8; Barclay and Halpin 1999, 28–31, fig. 3.5) or another, mentioned below, at Fengate, Cambridgeshire (Pryor 1984, 19–27). A date on oak charcoal from the trunk provides a *terminus post quem* of 4040–3700 cal BC (95% confidence; OxA-3301; Table 6.4). Nearby in the same excavated area was a cluster of intercutting pits and hollows, three of them containing plain Bowl pottery and some struck flint (Niblett 2001, 163–6, 173–5).

6.2 The Great Ouse catchment

6.2.1 Great Wilbraham, Cambridgeshire, TL 5395 5780

Location and topography

The Great Wilbraham enclosure lies a little to the east of Cambridge, 70 km north-east along the Chalk Ridge from Maiden Bower (Fig. 6.1). It occupies a low sandy terrace at 13 m OD on the north-facing side of the valley of the Little Wilbraham River, a tributary of the Cam, which in turn flows into the Great Ouse (Fig. 6.7; Oswald *et al.* 2001, figs 4.7, 5.19). It consists of two closely spaced concentric circuits with an overall area of about 2.5 ha, their northern edge obscured by the peat which fills a small basin in the valley, separated from the main body of the Fens (Fig. 6.7).

History of investigation

The site was discovered from the air in 1972, and in 1975 became the focus of a project initiated by David L. Clarke, who sadly died the following year. The first season of work was directed by Clarke and John Alexander and the second and final season, in 1976, by John Alexander and

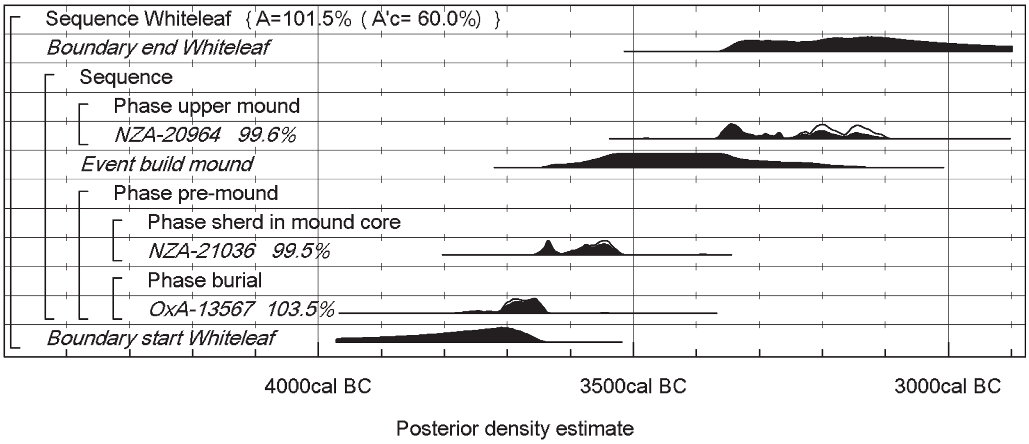


Fig. 6.6. Whiteleaf barrow. Probability distributions of dates. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Ian Kinnes. The project was to entail inter-disciplinary investigation of the entire enclosure and a sample of its surroundings, with an emphasis on the recovery of environmental and economic evidence. It was envisaged as an experiment in information retrieval, fuelled by the continuous formulation, assessment and reformulation of questions over a number of years, and stimulating the development of integrated field and laboratory techniques. It also served as a training excavation for Cambridge students (C. Evans *et al*. 2006). In the event, small-scale, exploratory excavations in 1975 were followed, after Clarke's death, by only one further season, itself of limited scope, the whole entailing four narrow sections across the inner ditch and two across the outer, with a small area of adjacent surface and two sections extending into the valley deposits (Fig. 6.7). In the early twenty-first century the archive was analysed and a publication achieved by Chris Evans and Mark Edmonds (C. Evans *et al*. 2006), without any further excavation of the site, which was by then a scheduled ancient monument. It was, however, possible for Oxford Archaeotechnics to make a geophysical survey of the enclosure and for Steve Boreham to undertake palaeoenvironmental investigations in the valley of the Little Wilbraham River, adjacent to the site.

The 1975–6 excavations showed that both ditches had been backfilled and recut and were rich in finds, spectacularly more so, in proportion to the amount of ditch excavated, than Briar Hill, Haddenham or Etton (C. Evans *et al*. 2006, table 12).

The Neolithic lithics included material from the Chalk, alongside a majority from a nearby gravel terrace; a fairly low representation of the early stages of the reduction sequence suggested that these may have been to some extent undertaken at source. There were also fragments of group I and group VI axeheads. There was no sign of other than local clays among the Mildenhall Ware assemblage, which included some elaborately decorated pots. The site was also occupied in the Bronze Age, Iron Age, Romano-British and later periods.

During the earlier fourth millennium, the higher, better drained ground north and south of the enclosure would have carried mixed deciduous woodland, with damp deciduous woodland with alder on the lower ground closer to the river and below the springline, where the enclosure was built. Peat fen probably occupied the wider part of the valley to the west, and a lake system the more constricted part of the valley to the north and east (C. Evans *et al*. 2006, 154).

Previous dating

During the 1975–6 project, a piece of waterlogged worked oak from the peats to the north of the enclosure, thought to pre-date a possible cropmark henge, was submitted to the British Museum and dated to the later first millennium cal BC (BM-1181; Table 6.2; Burleigh and Matthews 1982). An untraced sample from the peats farther downslope is reported to have yielded a Mesolithic date (C. Evans *et al*. 2006, 128).

In the 2000s, two further samples were submitted from the enclosure. The only charred grain from a Neolithic context proved to be modern (Table 6.2: Beta-203841) and charcoal from the base of the outer ditch dated to the second quarter of the second millennium cal BC (Table 6.2: Beta-203842), suggesting that it must have been intrusive, since the quantity and preservation of Neolithic pottery from the ditch (Knight 2006c) made an Early Bronze Age date implausible (C. Evans *et al*. 2006, 128–9). Two samples of organic material from boreholes in each of the two channels in the valley north of the enclosure were dated to anchor the pollen sequences (Table 6.2: Wk-17024–5, -17158–9; Boreham 2006, 147–9).

The enclosure remains undated. It was not possible to locate any further suitable samples.

6.2.2 Haddenham, Cambridgeshire, TL 41200 73650

Location and topography

The Haddenham causewayed enclosure lies at 2.10–2.60 m OD on the centre and sides of a buried gravel spur, projecting from the Upper Delphs terrace, approximately 1.5 m east of the then main course of the Great Ouse (Fig. 6.1). The locality is low-lying, the most prominent

Table 6.2. Radiocarbon dates from Great Wilbraham, Cambridgeshire.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)
Outer ditch						
Beta-203842	GW19428296	Charcoal	From bottom of outer ditch	3350±40		1750–1520
Beta-203841	GWIIe20	Charred seed	From the outer ditch	119.3±0.3 pMC		after AD 1955
Valley sediments						
BM-1181		*Quercus* sp. wood, worked	In peat deposit cut by 'henge' (Burleigh and Matthews 1982)	2280±60	−25.2	410–190
Wk-17159	Gt Wilb. 25 m 135-145	Bulk sample of peat	Small channel at 25 m along section A, Unit II in text, Unit III on section. From the smaller of two palaeochannels encountered in a series of boreholes across the valley of the Little Wilbraham river, immediately N of the Great Wilbraham causewayed enclosure. Pollen from an equivalent deposit reflected a predominance of pine with some birch and hazel (Boreham 2006)	10573±78	−29.6±0.2	10860–10290
Wk-17158	Gt Wilb 25 m 105-115 cm	Bulk sample of peat	Small channel at 25 m along section A, Unit II in text, Unit III on section. From the smaller of two palaeochannels encountered in a series of boreholes across the valley of the Little Wilbraham river, immediately N of the Great Wilbraham causewayed enclosure. Pollen from an equivalent deposit reflected a predominance of hazel with some pine (Boreham 2006)	7468±55	−28.3±0.2	6450–6220
Wk-17025	Gt Wilb. 60m 156-162	Bulk sample of peat	Large channel at 60 m along section A, Unit II. From the larger of two palaeochannels encountered in a series of boreholes across the valley of the Little Wilbraham river, immediately N of the Great Wilbraham causewayed enclosure. Pollen from this level reflected high frequencies of pine (Boreham 2006)	8692±54	−29.3±0.2	7940–7580
Wk-17024	Gt Wilb 60m 136-141 cm	Bulk sample of sediment	Large channel at 60 m along section A, Unit IV. From the larger of two palaeochannels encountered in a series of boreholes across the valley of the Little Wilbraham river, immediately N of the Great Wilbraham causewayed enclosure. Pollen from this level reflected high frequencies of grasses and few trees (Boreham 2006)	3785±51	−29.8±0.2	2440–2030

landmark being the rise of the Isle of Ely to the north-east (up to 30 m OD). During the Neolithic period the area was dry land, with wetland conditions confined to the channels of the river (Waller 1994, fig. 5.16). Despite increasingly wet conditions during the third millennium cal BC (Waller 1994, fig. 5.17), the higher parts of the Upper Delphs terrace itself seem to have been inundated only in the first millennium cal BC (Cloutman 2006, 206). The enclosure was recognised by aerial photography in 1976, although a length of its circuit is visible on an earlier photograph of 1969. It consists of a single circuit of irregular, sub-trapezoidal plan, which encloses an exceptionally large area (8.75 ha), and was backed by a palisade. There is an apparent gap on the lower, north-western side (Fig. 6.8).

Two, possibly three, long barrows lie on the higher ground of the Foulmire Fen terrace to the north, and an impressive number of round barrows are clustered in groups on the gravel terraces along the southern bank of the Ouse. Further north, this barrow field continues on the north bank of the Ouse at Chatteris (Evans and Hodder 2006, fig. 1.1). One of the long barrows at Foulmire Fen was waterlogged and has been extensively excavated (Evans and Hodder 2006, chapter 3).

The area was field-walked during the Fenland Survey, which identified an early flint scatter, containing both Mesolithic and Neolithic artefacts and a flake from a ground axe, at Cracknell Farm, 600 m north-west of the enclosure (Hall 1996, 61, 64; Evans and Hodder 2006, 217–22). Further Mesolithic and early Neolithic activity is evidenced by lithic scatters at Over Site 1 (Hall 1996, 147; Evans and Webley 2003) in the Sutton water meadows west of the Ouse palaeochannel (Hall 1996, 54).

Following on Hall's work at Over, landscape-scale investigations on both sides of the river in the Barleycroft-Over area (already in excess of 300 ha) have revealed widespread, low-density traces of early Neolithic activity (Evans and Knight 2000; 2001; Evans and Hodder 2006, 15, 230–2, 236, 357). Subsequent Neolithic activity is represented by later Grooved Ware pit complexes at Over (Pollard 1998).

History of investigation

From 1981–7 the Haddenham causewayed enclosure formed part of a research and training excavation undertaken by the Department of Archaeology, Cambridge University, under the direction of Ian Hodder and Chris Evans (Evans and Hodder 2006, chapter 5). A total of *c.* 230 m of the ditch circuit were investigated, approximately a 20% sample. In contrast, excavation within the interior was limited to a sample of *c.* 5%, much of this being concentrated around the perimeter (Fig. 6.8).

At least 43 ditch segments have been identified. These appear to range in length from 5 m to 25 m, and to be separated by causeways ranging in width from 0.5 to 9.5 m (Fig. 6.8; Evans and Hodder 2006, table 5.2). The ditch is U-shaped in profile, approximately 2 m wide and between 1 and 1.5 m deep (Evans and Hodder 2006, figs 5.12, 5.15, 5.19, 5.21). The segments appear to have been frequently

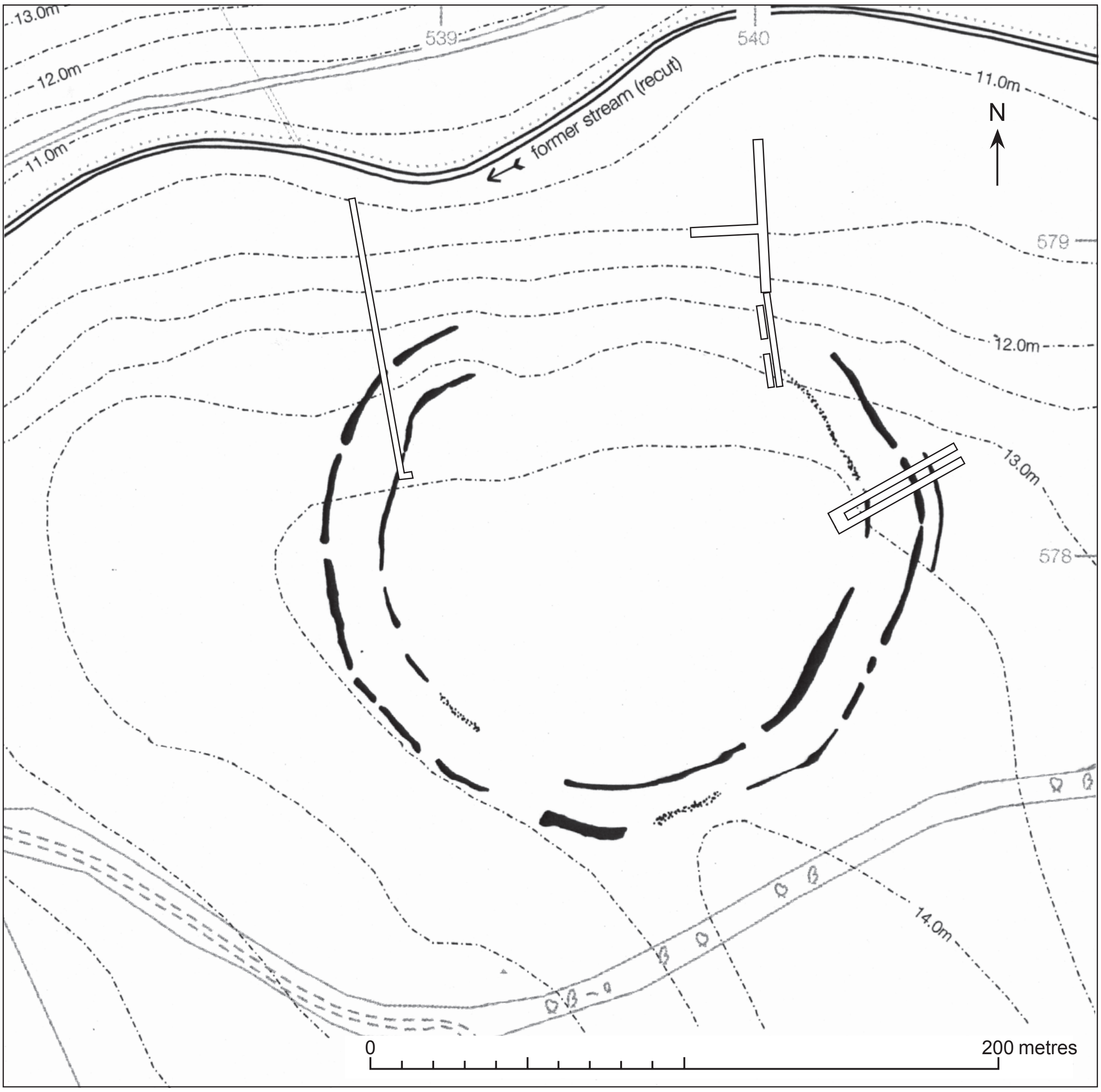


Fig. 6.7. Great Wilbraham. Plan showing cuttings. After Oswald et al. *(2001, fig. 4.7) and C. Evans* et al. *(2006, fig. 6).*

recut, perhaps with earlier fills containing 'placed' deposits (although these may simply have been a product of rapid infill) and later ones being associated with burning episodes. Some segments came to be joined by recuts.

An internal palisade follows the line of the enclosure ditch. Evidence for a bank is equivocal, a tentative suggestion of an internal bank between ditch and palisade being provided by the distribution of gravels in a transect excavated in 1987. No evidence of bank slip occurs within the ditches, however, and on the eastern side of the enclosure the palisade ran within 1.5 m of the ditch. This would leave insufficient space for a bank unless, as is of course possible, the palisade was cut through any bank. One Neolithic pit was found in the interior.

Overall the enclosure was extremely poor in finds, with only 1.85 kg of pottery of all kinds recovered from the ditch, against 1.16 kg from the single Neolithic pit, and only 474 pieces of struck flint from the ditch (Evans and Hodder 2006, tables 5.4 and 5.18; Knight 2006c; Middleton 2006d). There was only a slight Mesolithic presence (Middleton 2006d). The pottery from primary contexts was of local clays and belonged to the Mildenhall style. The struck flint, although predominantly from the local gravels, included a higher proportion of material brought from the Chalk than other sites investigated in the Haddenham project (Middleton 2006a; 2006b; 2006c). Peterborough Ware occurred in the upper fills, notably in the recut which provided the sample for HAR-8092; there were also very small amounts of Grooved Ware, Early Bronze Age and indeterminate late Neolithic/Early Bronze Age pottery (Gdaniec 2006). Later Neolithic lithics were also present in the upper ditch fills, especially in the north and east, and in parts of the interior. The most obviously placed deposit was of the butt of a group VI axehead on an axial ridge

Table 6.3. Radiocarbon dates from Haddenham, Cambridgeshire. Posterior density estimates derived from the model defined in Fig. 6.11.

Laboratory Number	**Sample reference**	**Material**	**Context**	**Radiocarbon Age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)* (Model 2: Fig. 6.11)**
Ditch							
HAR-10520	0362	Bulk sample of unidentified charcoal	Segment C, F42, context 362. From a burnt post in the secondary fills of the east side of the butt end of the causewayed enclosure ditch (Evans and Hodder 2006, 247–8)	4690±90	−24.7	3650–3120	*3635–3310* (*73%*) or *3245–3095* (*22%*)
HAR-8092	HAD84-I	Bulk sample of unidentified charcoal	Segment I, F120, context 1888. Recut near top of largely silted ditch, in burnt, charcoal-rich matrix including Peterborough Ware. No sign of burning *in situ* (Evans and Hodder 2006, fig. 5.15). Stratified above HAR-8096	4970±90	−27.0	3970–3530	*3965–3630*
HAR-8096	HAD84 VI	Bulk sample of unidentified charcoal	Segment I, F137, context 1747. Fill of S part of ditch around axial ridge from which primary silts had been cut away. Clay and gravel containing bone and charcoal bonded with heavy iron concretion, including human skull fragments. Stratified below HAR-8092	4630±80	−25.3	3640–3090	*3625–3585* (*2%*) or *3535–3085* (*93%*)
GrA-31185	C-14 CC (b)	Single fragment *Corylus avellana* or *Alnus glutinosa* or *Salix/Populus* sp.	Segment J, context 1866. From a ?solution hollow in the surface of the platform which supplied the sample for HAR-8093. The material may have been primary, carried up as the marl 'erupted' through the ditch fills, or, more probably, may have lain in the base of a recut (Evans and Hodder 2006, 255–7)	4400±35	−25.5	3270–2910	*3315–3290* (*1%*) or *3265–3235* (*5%*) or *3110–2915* (*89%*)
GrA-31184	C-14 CC (a)	Single fragment *Quercus* sp. sapwood	From the same context as GrA-31185	4415±35	−25.3	3320–2910	*3320–3230* (*10%*) or *3175–3155* (*1%*) or *3125–2915* (*84%*)
HAR-8093	III/84	Bulk sample of unidentified charcoal	Segment J, context 1841. From the surface of a possibly natural shell marl platform in the centre of the segment, overlying a small amount of initial silt and covered by a thin layer of sandy clay with charcoal and burnt bone (Evans and Hodder 2006, 255–7)	4560±90	−25.5	3630–2930	*3520–3075*
HAR-10512	HAD87CE	Peat	Segment O, context 3992. Although there is some slight doubt of the exact provenance of this sample, it appears to date the final recutting of this segment of the causewayed enclosure ditch (Evans and Hodder 2006, 263–4)	4490±140	−25.2	3640–2870	*3500–2915*
Internal features							
HAR-10518	3911	Bulk sample of unidentified charcoal	F534, context 3911. From a pit located in the middle of the causewayed enclosure, with substantial parts of 2 undecorated Bowls and 83 lithics, including 4 serrated flakes (Evans and Hodder 2006, figs 5.27–8)	4020±110	−26.8	2890–2200	
Palisade							
HAR-8094	HAD84-IV	Bulk sample of unidentified charcoal	F125, contexts 142–44. Burnt length of palisade inside segments I–H. Bulk sample from several post sockets (Evans and Hodder 2006, fig. 5.23)	3620±110	−25.0	2300–1680	

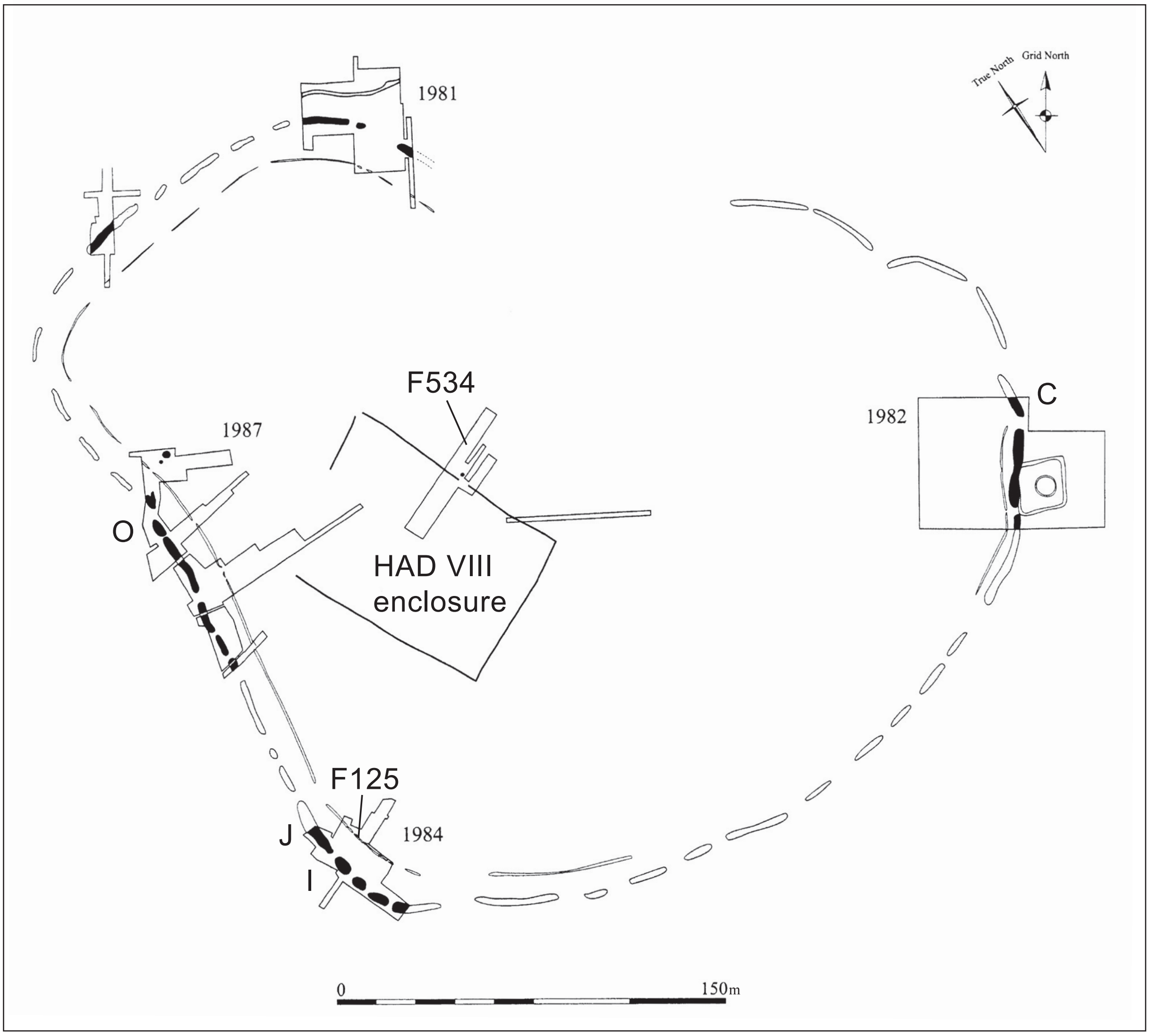


Fig. 6.8. Haddenham. Plan showing areas excavated. After Evans and Hodder (2006, fig. 5.1).

at the base of segment I. Although bone preservation was poor, human skull fragments were recovered from some segments, as were animal bone (mainly cattle) and antler implements. Charred cereals were essentially confined to pits of uncertain date cut into the enclosure ditch. The paucity of finds prompted the conclusion that there may have been no large gatherings at the enclosure other than those relating to construction (Evans and Hodder 2006).

A pollen sequence from the channel of the Great Ouse 4 km north-west of the enclosure and just over 1 km north-west of the excavated long barrow (Evans and Hodder 2006, fig. 1.2) extended from the eleventh millennium cal BC (95% confidence; 10980–10110 cal BC; Q-2816; Table 6.4) to the local onset of brackish conditions in the mid-third millennium (95% confidence; 2860–2140 cal BC; Table 6.4: Q-2813). The significant result as far as the enclosure and long barrow are concerned is the episode of clearance and cultivation mentioned above, starting just after 4460–3990 cal BC (95% confidence; 5420±100 BP; Table 6.4: Q-2814) and persisting through 1.25 m of peat (Peglar and Waller 1994; Peglar 2006). A graph of radiocarbon age against sediment depth for this sequence (Waller 1994, fig. 8.8) indicates that, if the peats here accumulated at a constant rate, this episode (local pollen zone OCH-4; Peglar and Waller 1994) ended *c*. 4500 BP (3340–3090 cal BC). If so, relatively open conditions would have obtained for most of the fourth millennium cal BC.

Previous dating

Seven samples were dated from the enclosure as part of initial post-excavation analysis in the late 1980s. Six were bulk samples of unidentified charcoal, and the seventh a bulk sample of peat. All were pretreated using the acid-alkali-acid method (Mook and Streurman 1983, 48–9). HAR-8094 was a small sample dated as carbon dioxide in the miniature gas proportional counter at AERE Harwell (Otlet and Evans 1983; Otlet *et al*. 1983; Otlet *et al*. 1986); the other samples were converted to benzene and dated by LSC (Otlet and Polach 1990). Excess material for HAR-8093–4 was retrieved from the Harwell laboratory on its demolition in the late 1990s. Unfortunately this was not identifiable (Rowena Gale, pers. comm.).

This suite of measurements was of limited utility in understanding the chronology of the enclosure. Six of the results were on bulk samples of charcoal which may have contained material of a range of ages or charcoal with a significant age offset. These dates provide *termini post quos* for the contexts from which they were recovered. Two of these were surprisingly late: the date of 2890–2200 cal BC (95% confidence; Table 6.3: HAR-10518) being unexpected for the undecorated Bowls and serrated flakes found in pit F534, and the date of 2300–1680 cal BC (95% confidence; Table 6.3: HAR-8094) being surprising for the material from the palisade which, since it follows the line of the enclosure ditch and gaps in both appear to coincide, was expected to be broadly contemporary with it.

Pit F534 was immediately outside the poorly dated, but perhaps Bronze Age, HAD VIII enclosure (Evans and Hodder 2006, fig. 5.27) and, given the anomalously late date for the finds assemblage within it, the sample may have included a component of intrusive charcoal from this activity. It is possible that HAR-8094 also contained intrusive charcoal and the palisade is in fact of Neolithic date. On the other hand, the sample did appear to consist of the charred remains of several posts, and features associated with the palisade contained as many late Neolithic or Bronze Age sherds as diagnostic early Neolithic sherds (Evans and Hodder 2006, table 5.23). The correspondence between the alignment of ditch and palisade and gaps in each also became increasingly inexact on the southern and western sides of the circuit (Fig. 6.8; Evans and Hodder 2006, fig. 5.1). The construction of a Bronze Age palisade, following the line of an upstanding Neolithic earthwork or even its silted ditch is, at least, possible. It should be noted, however, that the evidence for the causewayed enclosure bank is ambiguous.

The remaining dates from charcoal samples are from the ditch (Table 6.3). The latest of these, HAR-8093, was from a possibly natural shell marl platform overlying a small amount of initial silt in the centre of segment J. It may have come from a thin layer of sandy clay with charcoal and burnt bone which covered the platform. This measurement is statistically consistent with that on a sample of peat from segment O (Table 6.3: HAR-10512; T'=0.2; T'(5%)=3.8; ν=1). The exact provenance of this sample is slightly uncertain, but it appears to date a recut. Together these samples appear to suggest the use of the enclosure in the latter half of the fourth millennium cal BC.

Objectives of the dating programme
It was hoped to date the construction of the enclosure more precisely, and to determine for how long it was in use. It was also hoped to determine whether the palisade was Neolithic.

Sampling strategy
The potential for dating the Haddenham enclosure was limited by the small amount of cultural material recovered from the ditches. This was exacerbated by the abysmal collagen preservation of the bone assemblage (Brock *et al*. 2007b), particularly unfortunate as both antler tools which may have been used to dig the ditches and articulated animal bone are still available in archive. Four samples of animal bone were sent for AMS dating, but failed to produce sufficient protein for combustion.

The search for samples therefore concentrated on charcoal from *in situ* burnt deposits or discrete dumps in the fills of the ditches, charcoal from the slot of the palisade, and carbonised residues adhering to sherds from the ditch.

Unfortunately no carbonised residues were found, and many of the contexts identified as potentially suitable for dating from the site report had not been sampled for charred plant remains. Only one suitable sample was identified, a concentration of charcoal from context 1866, the fill of one of several possibly natural hollows in the surface of the marl platform in segment J. Two samples of short-lived charcoal were dated from this deposit.

Results and calibration
Details of the nine radiocarbon determinations from the Haddenham causewayed enclosure are provided in Table 6.3.

Analysis and interpretation
Two alternative models for the chronology of the Haddenham causewayed enclosure are presented in Figs 6.9 and 6.11.

Radiocarbon dates have been obtained from four ditch segments. *HAR-10520*, a sample of unidentified charcoal from a burnt post in the secondary fill of segment C, provides a *terminus post quem* for its infilling. Two samples of unidentified charcoal from segment I provide *termini post quos* for its infilling. *HAR-8092* at least must have contained old wood as it is significantly earlier than *HAR-8096* which was stratified below it (Fig. 6.9). In segment J, *HAR-8093*, a sample of unidentified charcoal from a possibly natural shell marl platform above the initial silts, provides a *terminus post quem* for the formation of that platform and for the fragments of short-life charcoal from a hollow in its surface (Fig. 6.9: *GrA-31184–5*). The measurements on these two charcoal fragments are statistically consistent with each other (T'=0.1; T'(5%)=3.8; ν=1), and with the measurement on the bulk charcoal (T'=2.8; T'(5%)=6.0; ν=2). This may suggest that the latter does not, in fact, have a significant age-at-death offset. Finally, *HAR-10512*, a result from a bulk peat sample in segment O, is also consistent with this group (T'=3.1; T'(5%)=7.8; ν=3).

For the reasons given above, it is suspected that HAR-10518 may have contained intrusive charcoal and provides an unreliable date for its context. It has therefore been excluded from the model. Either HAR-8094 is similarly unreliable and the palisade is in fact Neolithic, or the palisade is Bronze Age. In either case, this measurement has also been excluded from the model.

The model shown in Fig. 6.9 suggests that the causewayed enclosure at Haddenham was constructed in *3820–2930 cal BC* (*95% probability*; Fig. 6.9: *start Haddenham*), probably

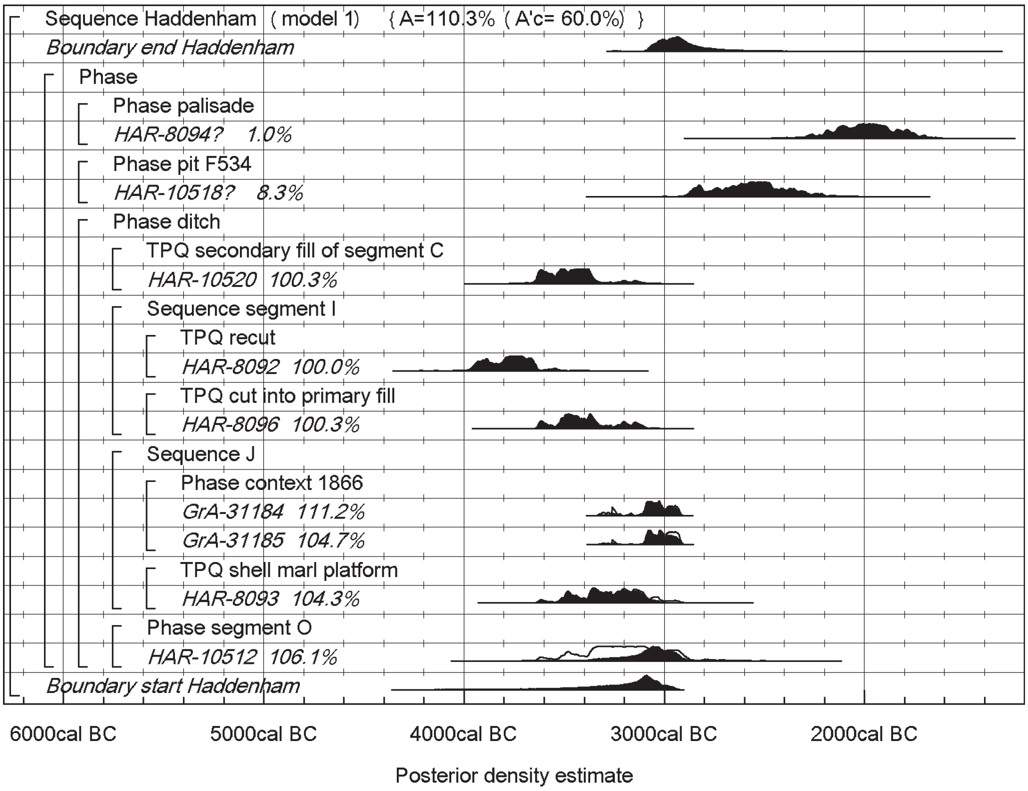


Fig. 6.9. Haddenham. Probability distributions of dates, interpreting all results from samples of unidentified charcoal as termini post quos *for the contexts from which they were recovered (model 1). The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.*

in *3290–2975 cal BC* (*68% probability*). The ditches had infilled by *3100–2460 cal BC* (*95% probability*; Fig. 6.9: *end Haddenham*), probably by *3065–2860 cal BC* (*68% probability*). Overall the enclosure was in use for *1–1095 years* (*95% probability*; Fig. 6.10: *use Haddenham* (*model 1*)), probably for *1–400 years* (*68% probability*). The large uncertainty on this estimate is an artefact of a statistically inadequate series of dates, but the shape of this distribution does suggest that the Haddenham enclosure may have been in use for a relatively short period of time.

If the chronology suggested by this model is accurate, then the Haddenham enclosure was constructed and used within a century or so of 3000 cal BC. In favour of the accuracy of this dating is the consistency of the results on the three samples of short-life material. It may also be suggestive that the four samples closest to the bottom of the ditch (*HAR-8093*, unidentified; *GrA-31184–5*, short-lived and probably stratigraphically later than *HAR-8093*; and *HAR-8096*, unidentified and post-dating the primary fills) are relatively late (Fig. 6.9). Against the accuracy of this model is the fact that such a late date would be incompatible with the artefact assemblage and with the dating of causewayed enclosures in general. It is also possible that the short-life samples currently dated are from late in the use-life of the enclosure as, if the marl in segment J was naturally deposited by springs, these could have disrupted the initial gravel fills. The fact remains that we have no dates on samples from the bottom of the ditch.

An alternative model was therefore constructed (Fig. 6.11). In this reading it is assumed that the burnt post in the secondary fills of segment C which is dated by *HAR-10520* was from a relatively short-lived timber. The material which formed *HAR-8096* is also assumed to have been short-lived, although *HAR-8092* is still treated as a *terminus post quem*. Finally, *HAR-8093* is also assumed to have been made up of short-lived material. Since this measurement is statistically consistent with those from a hollow in the top of the platform, this interpretation is plausible.

According to this reading, the construction of the causewayed enclosure began in *3960–3125 cal BC* (*95% probability*; Fig. 6.11: *start Haddenham*), probably in *3725–3365 cal BC* (*68% probability*). The enclosure ditches were infilled by *3265–2490 cal BC* (*95% probability*; Fig. 6.11: *end Haddenham*), probably by *3065–2825 cal BC* (*68% probability*). The enclosure was in use for *60–1290 years* (*95% probability*; Fig. 6.12: *use Haddenham* (*model 2*)), probably for *335–910 years* (*68% probability*).

Implications for the site

Our understanding of the chronology of the Haddenham causewayed enclosure is inadequate. This is demonstrated by the significant differences between chronological models incorporating different readings of the archaeological evidence.

Comparison of the results of the two models demonstrates that both agree in placing the final recutting and use of the ditch circuit in the centuries around 3000 cal BC (Figs 6.9 and 6.11). They differ significantly, however, in placing the

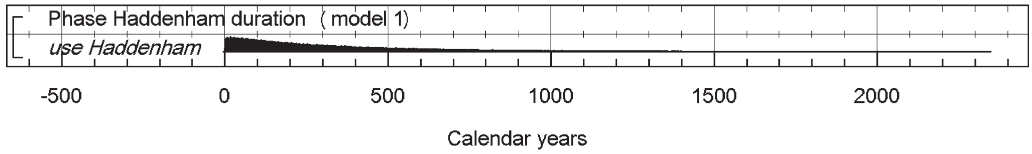


Fig. 6.10. Haddenham. Number of years during which the enclosure was in use, derived from the model defined in Fig. 6.9.

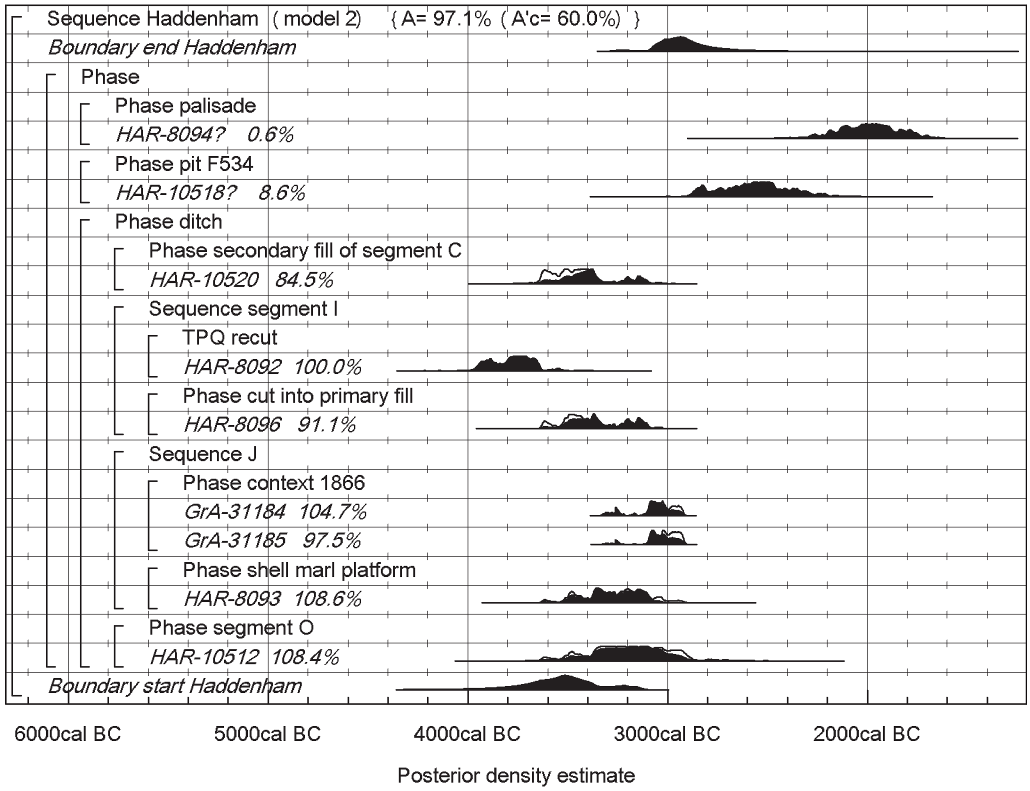


Fig. 6.11. Haddenham. Probability distributions of the dates, interpreting all results from samples of unidentified charcoal as providing plausible dates for the contexts from which they were recovered, except for HAR-8092 (model 2). The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

construction of the enclosure in the later fourth millennium (model 1; Fig. 6.9) or the mid-fourth millennium (model 2; Fig. 6.11). The calendar date of Neolithic features in the interior is unknown and it is unclear whether the palisade which follows the line of this circuit is contemporary with it, or a much later Bronze Age reuse of the site.

Both models produce imprecise estimates for the duration of the use of the enclosure, although again they differ significantly, with model 1 favouring a shorter usage (Fig. 6.10) and model 2 a use spanning several centuries (Fig. 6.12). The artefact assemblage and the form of the monument are more compatible with the chronology suggested by model 2. Overall, we think that model 2 is more plausible.

The clearance and cultivation phase identified 4 km to the north probably started before the enclosure was built.

6.2.3 Implications for the Great Ouse catchment

Below the Chiltern scarp, on the gravel terraces of the Great Ouse and its tributaries, Mesolithic settlement along the valley (M. Dawson 2000) was a prelude to extensive settlement and ceremonial use from the fourth millennium onwards, when, at least in the Barleycroft-Over area of the lower reaches, a narrow Mesolithic focus on the river edges gives way to a wider spread of early Neolithic lithics across the terrain (Evans and Knight 2000, 94). From the Biddenham Loop west of Bedford downstream to the Fens, there are at least six complexes including cursus monuments within a distance of 30 km, generally sited near confluences of tributaries with the main course of the river (Malim 1999; 2000). Their components are typically located on slight rises in the gravel terrace. Smaller linear monuments are also exceptionally frequent in these groupings, in close but diverse relations to palaeochannels and to the river itself. Neolithic pits have often been found where area excavations have been undertaken in and around these complexes, although their precise dates and contents are not always apparent from interim reports.

The virtually uninvestigated causewayed enclosure at

Table 6.4. Radiocarbon dates from the Chilterns, the Great Ouse catchment and the southern fenland basin. Posterior density estimates derive from the models defined in Figs 6.6, 6.13, and 6.15–18.

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Whiteleaf, Buckinghamshire							
OxA-13567	PRWLH34-39	Human. Skull fragment from male >50 years old	From skeleton of mature male, whose left foot remained inside a post-built burial chamber, while most of the bones were disarticulated and scattered in an area approx. 2.5 m x 1.2 m in front of it (Childe and Smith 1954, 216, 220)	4900±33	−21.1	3760–3630	*3760–3740* (2%) or *3715–3635* (93%)
NZA-21036	PRWLH34-39 (65, 59, 1)	Carbonised residue on sherd	Part of large assemblage of decorated Bowl pottery incorporated in inner mound of earth and flints, interspersed with patches of clay and occasional tips of chalk (Childe and Smith 1954, 215–16, 221–8)	4803±35	−27.1	3660–3520	*3655–3615* (27%) or *3610–3520* (68%)
NZA-20964	PRWLH03 4104	Red deer. Antler	Found in 2003 re-excavation in upper part of mound, overlying the chalk and earthy chalk rubble which capped the inner mound (Childe and Smith 1954, pl. XXIV). This final stage of the mound may, like a modification of the surrounding ditch, relate to an enlargement of the mound (Gill Hey pers. comm.; Hey *et al.* 2007)	4537±30	−23.7	3370–3090	*3365–3260* (50%) or *3245–3110* (45%)
Gorhambury, Hertfordshire							
HAR-3484	GORH 1715	Bulk sample of mature *Quercus* sp. charcoal	1715. One of 5 slots, all packed with clay and containing charcoal, defining a rectangular structure 7 m wide and >9 m long. In 1715 the charcoal ran along the outer edge of the slot, there were sherds of plain Bowl and, in the upper fill, and daub fragments. The 5 slots together yielded 18 pieces of struck flint including blades (Neal *et al.* 1990, 7–9, 175–6; 218–21)	4810±80	−25.6	3760–3380	
Old Parkbury Farm, Colney Street, Hertfordshire							
OxA-3301	F89.77	*Quercus* charcoal	From charred, hollowed oak trunk containing cremated human bone (R. Hedges *et al.* 1994, 354; Niblett 2001, 157–62)	5080±75	−26.0	4040–3700	
Plantation Quarry, Willington, Bedfordshire							
OxA-4553		Human. Articulated skeleton of young adult female	Prone and crouched at one side of an ovoid grave surrounded by a square ditch, accompanied by a red deer antler chopped off above the coronet, with a broken chert flake and crumbs of indeterminate pottery in the fill (Dawson, 1996, 4–11)	4530±130	−22.3	3640–2890	
Broom Quarry, Biggleswade, Bedfordshire							
OxA-8116	BRQ F415[1351-2<c.001>	Charred hazelnut shells	F415. Pit with plain Bowl pottery, struck flint, burnt and unburnt animal bone, charred hazelnut shells, a little charred emmer wheat (Cooper and Edmonds 2007; David Gibson pers. comm.)	4940±45	−23.0	3900–3640	
Eynesbury, Cambridgeshire							
NZA-14576	Sample 1542	*Quercus* sp. sapwood charcoal (Ellis 2004, 13, table 16)	2715. Dump of burnt material in pit 2716, which contained plain Bowl pottery and lithics including a leaf arrowhead (Ellis 2004, 13–15, 63)	4743±60	−24.1	3650–3360	
NZA-14329	Sample 1580	*Quercus* sp. sapwood charcoal	5183. Fill of pit 5181, described as blocking N entrance of hengiform enclosure 2513, although there is no clear stratigraphic relation between the two and finds distribution suggests that entrance was in SE (Ellis 2004, 7–13, 63)	4995±65	−23.9	3960–3640	
NZA-14465	2380	Red deer. Antler	6301. Base of ‘long barrow’ ditch 6284 (Ellis 2004, 16–23, 63)	4004±55	−22.6	2840–2340	
NZA-14285	2347	Waterlogged *Quercus* sp. tree trunk, *c.* 250–300 years old when felled	6331. Fill of pit 6332, cut into primary and lower secondary fills of ‘long barrow’ ditch (Ellis 2004, 20–3, 60–3)	3737±60	−23.2	2280–2030	*2240–1870*[1]

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	δ^{13}C (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
NZA-14330	Sample 1616	*Quercus* sp. sapwood charcoal	2859. Unurned cremation in pit 2856, cut into silted ditch of N cursus	2980±60	−24.7	1410–1010	
Brampton, Cambridgeshire							
GU-5265		*Quercus* charcoal	Pit cutting silted S ditch of oval enclosure 90 m x 17–20 m (Malim 2000)	4140±140	−25.2	3090–2290	
Rectory Farm, Godmanchester, Cambridgeshire							
OxA-3370		Charcoal (unidentified)	Postpipe 9829 in posthole 9827, one of 24 lining inner edge of trapezoid enclosure ditch (McAvoy 2000; Malim 2000). Section accompanying submission form shows a concentration of charcoal in a clear postpipe	5050±80	−25.2	4040–3650	*3985–3660*
OxA-3646		Charcoal (unidentified)	Postpipe fill 4342 in posthole 9783, one of 24 lining inner edge of trapezoid enclosure ditch (McAvoy 2000; Malim 2000). Section accompanying submission form shows that this was from an *in situ* charred post	5035±70	−23.7	3970–3660	*3970–3690* (*94%*) or *3680–3665* (*1%*)
OxA-3367		Charcoal (unidentified) from base of charred post	Charred post in posthole 9349, one of 24 lining inner edge of trapezoid enclosure ditch (McAvoy 2000; Malim 2000)	4950±80	−25.9	3960–3530	*3955–3630*
OxA-3369		Charcoal (unidentified)	Postpipe of 9802 in posthole 9801, one of 24 lining inner edge of trapezoid enclosure ditch (McAvoy 2000; Malim 2000)	4850±80	−24.0	3900–3370	*3800–3495* (*90%*) or *3440–3375* (*5%*)
OxA-3491		Charcoal (unidentified)	Postpit 9805 of posthole 9801, one of 24 lining inner edge of trapezoid enclosure ditch (McAvoy 2000; Malim 2000)	4360±75	−26.4	3340–2870	
OxA-2323		Red deer. Antler	Postpit of 9474, one of postholes lining inner edge of trapezoid enclosure ditch, 0.90 m from surface (McAvoy 2000; Malim 2000)	4220±90	−23.3	3090–2490	
OxA-3366		Charcoal (unidentified)	Cremation deposit cut into ditch which cut ditch of rectangular enclosure 17.70 m x 16.30 m, the only finds from which were a few possibly Neolithic sherds (McAvoy 2000, 55)	3390±75	−26.9	1890–1500	*1885–1510*
AA-9569		Cattle. L and R mandibles	Top of primary fill in 9206, N terminal of ditch of trapezoid enclosure (McAvoy 2000, 51)	3740±55	−26.0	2300–1970	
OxA-4360		Cattle. Limb bone	In base of primary silts which had formed around cattle skull in base of 9201, S terminal of ditch of trapezoid enclosure (McAvoy 2000, 51)	4775±100	−21.7	3780–3350	*3770–3360*
GU-5266		Small waterlogged twigs	Pit 9963. Pit cutting infilled enclosure ditch near its junction with the cursus (McAvoy 2000, fig. 7.4; Malim 2000)	4000±60	−27.6	2620–2460	*2840–2810* (*2%*) or *2680–2295* (*93%*)
GU-5267		Small waterlogged twigs	Pit 9970. Pit cutting infilled enclosure ditch near its junction with the cursus (McAvoy 2000, fig. 7.4; Malim 2000)	3830±60	−27.2	2470–2050	*2470–2130*
GU-5213		Waterlogged wattle fence or lining	Pits 9964, 9966, 9967, 9978. Pit sequence cutting infilled enclosure ditch near its junction with the cursus (McAvoy 2000, fig. 7.4; Malim 2000)	3240±50	−24.8	1630–1410	*1625–1415*
Barleycroft Paddocks, Cambridgeshire							
OxA-8110	BAR F591[869A]	Charred hazelnut shells	F591. Treethrow hole containing 1.638 kg of plain Bowl pottery of Grimston Ware affinities and 319 pieces of struck flint (C. Evans *et al*. 1999)	4920±40	−24.4	3790–3630	
OxA-8108	BAR F463[643]	Charred hazelnut shells	F463. Pit containing 1.229 kg of Mildenhall Ware and 255 pieces of struck flint (C. Evans *et al*. 1999)	4820±45	−25.1	3700–3520	

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
Colne Fen, Earith, Cambridgeshire							
Beta-215397		Charcoal	F762. Pit with plain Bowl pottery (C. Evans *et al.* forthcoming)	4910±40	-25.0	3780–3630	
Haddenham long barrow							
HAR-9171	HAD6LB25 [3399]	*Quercus* sp. charcoal. Charcoal from this context in general came from large oak trees (Evans and Hodder 2006, 97)	F710. Found with a few g of cremated human bone beneath mortuary structure banks	4660±50	−26.3	3630–3350	*3630–3575* (*9%*) or *3535–3350* (*86%*)
HAR-9176	HAD6LB11 [3271]	Charred, waterlogged *Quercus* sp. wood	F714. From a post of the façade. Postpipes 0.40 to 0.75 m by 0.20 to 0.30 m, generally split trunks (Evans and Hodder 2006, 85, figs 3.16, 3.17, table 3.2)	5050±60	−26.9	3980–3700	*3965–3705*
HAR-9177	HAD6LB07 [3550]	Charred, waterlogged *Quercus* sp. wood	F727. Proximal roof timber	5140±70	−26.4	4230–3710	*4225–4205* (*1%*) or *4165–4125* (*2%*) or *4075–3760* (*92%*)
HAR-9172	HAD6LB17 [3575]	Charred, waterlogged *Quercus* sp. wood	F724. Proximal south wall timber	4960±90	−26.4	3960–3680	*3965–3630* (*94%*) or *3560–3535* (*1%*)
HAR-9175	HAD6LB26 [3692]	Charred, waterlogged *Quercus* sp. wood	F78. Floor timber — distal north	4950±70	−26.4	3950–3630	*3945–3635*
UB-3167	Sample 1 [3642/3645]	Waterlogged wood	F709. Plank on floor of proximal subchamber, rings 140–160	4947±20	−26.2±0.2	3780–3650	*3730–3715*
UB-3168	Sample 2 [3642/3645]	Waterlogged wood	F709. Plank on floor of proximal subchamber, rings 160–180	4900±18	−27.2±0.2	3710–3640	*3710–3695*
UB-3169	Sample 3 [3642/3645]	Waterlogged wood	F709. Plank on floor of proximal subchamber, rings 180–200	4891±18	−25.8±0.2	3710–3640	*3690–3675*
UB-3170	Sample 4 [3642/3645]	Waterlogged wood	F709. Plank on floor of proximal subchamber, rings 200–220	4893±18	−26.1±0.2	3710–3640	*3670–3655*
UB-3171	Sample 5 [3642/3645]	Waterlogged wood	F709. Plank on floor of proximal subchamber, rings 220–240	4874±20	−24.9±0.2	3660–3640	*3650–3635*
HAR-9173	HAD6LB14 [3271]	Burnt *Quercus* sp. wood	F720. Timber in one of several lenses of gravel in forecourt, overlain by façade bank, stratified below sample for HAR-9174	4730±80	−26.0	3660–3350	*3655–3355*
HAR-9174	HAD6LB22 [3093]	*Quercus* sp. charcoal	F739. Timber in façade bank, in one of various areas of burning above filled-in forecourt, stratified above sample for HAR-9173	4930±60	−26.3	3930–3630	*3940–3870* (*7%*) or *3815–3630* (*88%*)
HAR-9178	HAD LAURA [2913]	Human. Teeth	F742. Secondary inhumation in top of barrow mound (Evans and Hodder 2006, fig. 3.3)	5770±140	−21.3	4950–4340	
Haddenham Great Ouse channel							
Q-2816		Organic clay/silt	−4.94 to −5.00 m OD. Near base of channel at, in local pollen zone OCH-1, with late Devensian vegetation of open grassland with scattered shrubs (Peglar and Waller 1994)	10650±180	−25.0 (assumed)	10980–10110	
Q-2815	OUH-3	Detrital mud/undifferential peat with wood	−4.84 to −4.90 m OD. In local pollen zone OCH-2, predominantly grassland with increasing tree cover (Peglar and Waller 1994)	8250±120	−25.0 (assumed)	7570–7030	

Laboratory Number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Q-2814	OUH-2	Detrital mud	−4.29 to −4.25 m OD. Boundary of local pollen zones HA-1a and HA-1b, elm decline with slight increase in plantain, followed at −4.18 m by major drop in tree cover and increase in grasses and herbs in local pollen zone HA-2 (Peglar 2006) or OCH-4 (Peglar and Waller 1994)	5420±100	−25.0 (assumed)	4460–3990	
Q-2813	OUH-1	Undifferential peat/detrital mud	−3.28 to −3.33 m OD. At top of local pollen zone OCH-5 (Peglar and Waller 1994) or HA-3 (Peglar 2006), with an increase in woodland and a decrease in shrubs and herbs	3950±95	−25.0 (assumed)	2860–2140	
Peacock's Farm, Shippea Hill, Cambridgeshire							
Q-588	130 cm	Peat	Near base of lower peat close to base of channel. Black fen peat with coarse sand and some small wood. Contained pollen dominated by pine and hazel, with birch, elm, oak, willow (Clark and Godwin 1962, 16–21; Godwin and Willis 1962, 57)	8620±160		8230–7340	*8190–8030* (*13%*) or *8025–7580* (*82%*)
CAR-1102		Peat	Near base of lower peat close to base of channel (A. Smith *et al.* 1989, fig. 8). Peat with sand and gravel. Contained pollen dominated by *Corylus* and *Pinus*	9010±90		8420–7950	*8340–7785*
CAR-1101		Peat	Just below base of 'black band' (A. Smith *et al.* 1989, fig. 8). Pollen as CAR-1102	8600±80		7790–7520	*7790–7500*
Q-587	100 cm	Peat	'Black band' of fen peat with abundant coarse sand and late Mesolithic lithics. Later part of pollen zone VI with 80% *Pinus* (Clark and Godwin 1962, 16–21; Godwin and Willis 1962, 57)	7610±150		6750–6210	*7030–6930* (*6%*) or *6920–6875* (*3%*) or *6850–6465* (*86%*)
CAR-1100		Peat	B2/B3. Junction of band of grey sand near base of 'black band' (B2) with almost black sandy amorphous peat (B3) above it (A. Smith *et al.* 1989, fig. 8), also junction of local pollen zones PF1-1 (pollen as above) and PF1-2, with (pollen dominated by *Cyperaceae* with *Corylus* and *Pinus*, marked by higher values for herbs; A. Smith *et al.* 1989, 217)	8250±80		7520–7060	*7485–7075*
CAR-1099		Peat	B3. Band of almost black sandy amorphous peat within 'black band' (A. Smith *et al.* 1989, fig. 8). Local pollen zone PF1-2 (pollen as above)	7740±80		6740–6430	*6665–6425*
CAR-1098		Peat	B5. Almost black sandy wood peat near top of 'black band' (A. Smith *et al.* 1989, fig. 8). Local pollen zone PF1-3, dominated by *Alnus*, with *Quercus*, *Tilia* and *Corylus*, level of herbs falling from soon after start (A. Smith *et al.* 1989, 217–18)	7110±80		6100–5830	*6210–6135* (*3%*) or *6110–5800* (*92%*)
Q-586	90 cm	Peat	Top of 'black band' of fen peat with abundant coarse sand and late Mesolithic lithics. Early part of pollen zone VIIa, with 40% *Alnus*, 30% *Tilia* (Clark and Godwin 1962, 16–21; Godwin and Willis 1962, 57)	6675±150		5880–5320	*5880–5325*
CAR-1097		Peat	B6. Dark brown sandy wood peat transitional between 'black band' and overlying peat (A. Smith *et al.* 1989, fig. 8). Local pollen zone PF1-3 (pollen as above)	5940±80		5010–4610	*5030–4610*
Q-585	70 cm	Peat	Black fen peat with small wood and a little fine sand. Just below Neolithic layer and sample for Q-584 (Godwin and Willis 1961; Clark and Godwin 1962, 16–21)	5330±120		4450–4240	*4450–4065*
CAR-1096		Peat	Wood peat with sand, above CAR-1097 (A. Smith *et al.* 1989, fig. 5). Local pollen zone PF1-3 (pollen as above, but sample taken from just above elm decline, while others were below it (A. Smith *et al.* 1989, 218)	5540±80		4540–4240	*4545–4245*

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
Q-584	65 cm	Peat	Black fen peat with small wood and a little fine sand. Base of Neolithic layer and level of first *Plantago lanceolata* pollen (Godwin and Willis 1961; Clark and Godwin 1962, 16–21)	5465±120		4550–3990	*4330–3970*
Q-525/6	Charcoal samples 1 and 2	Charcoal (unidentified)	Amalgamation of 2 samples collected 18.55 m west and 20.62 m south and 18.49 m west and 20.90 m south (Clark and Godwin 1962, fig. 3). From scatter of struck and burnt flint, animal bone and charcoal in sand-rich band in Lower Peat, extending outward from sandhill. From section cut in 1960. Equated with comparable horizon encountered nearby in 1934 which included sherds of at least 7 well made, plain, light-rimmed, concave-necked Bowls, in one case shouldered (Clark *et al.* 1935, 228–303; Godwin and Willis 1961; Clark and Godwin 1962)	4870±120		3960–3360	*3960–3590*
Q-527/8	Charcoal samples 3 and 11	Charcoal (unidentified)	Amalgamation of 2 samples collected 18.37 m west and 20.67 m south and 18.71 m west and 20.24 m south (Godwin and Willis 1961; Clark and Godwin 1962, fig. 3). From the same deposit as samples for Q-525/6	4950±120		3980–3380	*3990–3630*
CAR-790		Rib fragment, and metatarsal fragment, both probably of deer, the latter with shallow scratches of uncertain origin	Lower Peat on S side of sandhill, 5 m from N end of trench A (1983) 'just above the interface with the basal sand'	4970±80		3960–3630	*3950–3655*
Q-583	50 cm	Peat	Black fen peat with small wood and a little fine sand. Top of Neolithic layer (Godwin and Willis 1961; Clark and Godwin 1962, 16–21)	5295±120		4360–3800	
Q-582	35 cm	Peat	Black sedge peat with small wood. Midway between top of lower peat and Neolithic layer. Maxima in curves for *Quercus*, *Fraxinus* and *Hedera* and end of continuous curve for *Plantago lanceolata* (Godwin and Willis 1961; Clark and Godwin 1962, 16–21)	5310±120		4370–3810	
CAR-1105		Peat	Wood peat with reed swamp (A. Smith *et al.* 1989, fig. 5). Local pollen zone PF1-3 (pollen as above)	4910±90		3905–3520	*3770–3505* (*91%*) or *3425–3380* (*4%*)
CAR-1104		Peat	Wood peat with reed swamp (A. Smith *et al.* 1989, fig. 5). Just below top of local pollen zone PF1-3 (pollen as above)	4520±70		3500–2930	*3500–3430* (*9%*) or *3380–3075* (*84%*) or *3070–3025* (*2%*)
CAR-1103		Wood	Near base of wood peat with reedswamp and clay, underlying fen clay (A. Smith *et al.* 1989, fig. 5). Local pollen zone PF1-4, dominated by Gramineae (probably mainly reeds) and marked by decline in tree cover, in face of increasing wetness. Sample thought perhaps to have included redeposited wood (A. Smith *et al.* 1989, 218)	5290±90		4340–3950	
Q-499	Sample 100	Wood of tree	Tree growing in wood peat not far below fen clay (Godwin and Willis 1961; Clark and Godwin 1962, 16–21)	4695±120		3710–3090	*3700–3385*
Q-581	5–6 cm	Peat	*Phragmites* peat just below Q-580 and slightly less clayey (Clark and Godwin 1962, 16–21)	5130±120		4240–3650	
Q-580	4–5 cm	Peat	Clayey *Phragmites* peat at transition to fen clay (Clark and Godwin 1962, 16–21)	4800±120		3910–3350	*3650–3315* (*92%*) or *3220–3175* (*2%*) or *3160–3120* (*1%*)

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
CAR-792		Charcoal (unidentified)	F10. One of 3 conjoined, irregular features on sand ridge (A. Smith *et al.* 1989, 220–3)	8370±100		7590–7080	*7590–7170*
CAR-793		Charcoal (unidentified)	From the same context as CAR-792	8130±100		7460–6770	*7455–7390 (3%) or 7380–6770 (92%)*
CAR-795		Charcoal (unidentified)	F18. One of 3 conjoined, irregular features on sand ridge (A. Smith *et al.* 1989, 220–3)	8490±90		7640–7350	*7720–7330*
CAR-796		Charcoal (unidentified)	F20. One of 3 conjoined, irregular features on sand ridge (A. Smith *et al.* 1989, 220–3)	7680±80		6660–6410	*6660–6395*
Letter F Farm, Littleport, Cambridgeshire							
CAR-376		Charcoal (unidentified)	Square 66, lower peat, with flint industry of Mesolithic/early Neolithic technology	4815±75		3750–3370	
CAR-378		Charcoal (unidentified)	Square 67, lower peat, with flint industry of Mesolithic/early Neolithic technology	4970±75		3960–3630	
CAR-379		Charcoal (unidentified)	Square 68, lower peat, with flint industry of Mesolithic/early Neolithic technology	5010±80		3980–3640	
CAR-377		Charcoal (unidentified)	Square 66, surface of sand beneath lower peat, with flint industry of Mesolithic/early Neolithic technology	4180±75		2920–2490	
CAR-380		Charcoal (unidentified)	Square 68, surface of sand beneath lower peat, with flint industry of Mesolithic/early Neolithic technology	5175±80		4240–3780	

1 The calibrated date has been offset by the number of missing heartwood rings present in the timber, and by the distribution of the number of sapwood rings for English oak (see Chapter 6, endnote 1).

Cardington, just south-east of Bedford, emerges from under alluvium on a slight gravel rise (Fig. 6.1; Oswald *et al.* 2001, fig. 4.10). It is a little higher than and separated by a tributary from the Octagon Farm complex which includes a cursus and several smaller elongated monuments, one of which contained a single sherd of plain Bowl pottery (M. Dawson 1993, 10; 1996, fig. 22; Malim 2000, 63, 75–8, fig. 8.13). In Willington Plantation in the east of the complex was a reminder that unfamiliar forms of fourth millennium monument are yet to be fully appreciated, in the form of a small, square, ditched enclosure which surrounded the skeleton of a young adult female buried prone and crouched at one side of an ovoid grave. She was accompanied by a red deer antler chopped off above the coronet, and the grave fill contained a broken chert flake and crumbs of indeterminate pottery. The skeleton is dated to 3650–2900 cal BC (95% confidence; Fig. 6.13; Table 6.4: OxA-4553; M. Dawson 1996, 4–11). On the opposite side of the Ouse is one of the relatively few securely identified small henge monuments in the valley, at Bunny Farm, Goldington (Baker and Mustoe 1988; Mustoe 1988), although there may be further examples among the ring ditches of the Octagon Farm and other complexes.

Excavation of a predominantly Bronze Age site at Broom Quarry on the Ivel, a tributary of the Great Ouse (Fig. 6.1), led to the discovery of a pit containing plain Bowl pottery and charred hazelnut shells dated to 3900–3640 cal BC (95% confidence; Table 6.4; Fig. 6.13: OxA-8116; Cooper and Edmonds 2007). More early Neolithic pits were found farther downstream in the Ouse valley itself during excavations in the monument complex at Eynesbury, near St Neots, by Wessex Archaeology in 2000–1. Seven pits were attributed to the early Neolithic (Ellis 2004, 13–16), one of them yielding a short-life sample dated to the mid-fourth millennium (Fig. 6.13: NZA-14576). A further pit, short-life material from which was dated to the early fourth millennium (Fig. 6.13: NZA-14329), may have closed, and hence post-dated, one entrance of a small, ovoid, enclosure less than 20 m across; the secondary and tertiary fills of this contained plain Bowl pottery and struck flint, both concentrated close to the second entrance, as well as some animal bone (Ellis 2004, 7–13). The relationship of the pit to the enclosure ditch is, however, less than clear, and it is possible that the pit was earlier.

Also in the Eynesbury complex (Fig. 6.1), a continuous-ditched earthwork, 59 m by 29 m, with vestigial traces of mound and external bank was interpreted as a long barrow. The ditch contained few artefacts, notable among them being a reflaked Group VI axehead and a quern fragment. On the ditch base, in the primary silts, and in localised recuts made into them, however, were antler picks, animal bone including cattle skulls (from either domestic bulls or female aurochs; Sykes 2004), and human remains from at least five individuals, including some bones which were still articulated (Ellis 2004, pl. VII). In a large pit cut into the primary and lower secondary fills was a tool-marked, inverted section of oak trunk roughly 0.50 m in diameter (Ellis 2004, 16–23). Eight bone and antler samples were

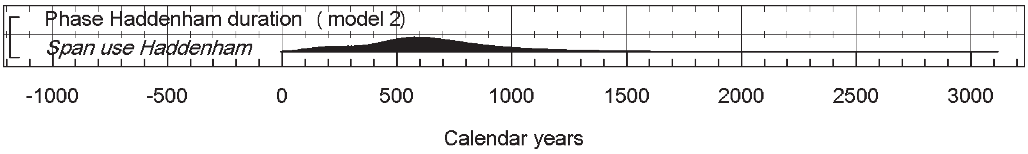


Fig. 6.12. Haddenham. Number of years during which the enclosure was in use, derived from the model defined in Fig. 6.11.

submitted for dating, seven of which failed to produce results because of mineralisation and chemical decay of the original bone protein (Beavan 2004). Because of the floodplain location of the site, the ditch had been wet through much of its history. The failure of seven samples raises the possibility that the remaining one, an antler from the ditch base dated by NZA-14465, may also have been deficient in collagen, although its carbon isotope values were within a reasonable range for preserved protein (Beavan 2004). If this measurement is taken at face value, and the antler is taken as having been used to dig the ditch, then its age would point to a construction date for the monument of 2835–2345 cal BC (95% confidence; Fig. 6.13: NZA-14465). While the monument is *sui generis*, the traditions combined in it are most readily paralleled in the earlier fourth millennium cal BC, and it may be that NZA-14465 is too young. On the other hand, there is no reason to doubt the accuracy of NZA-14285, which provides a *terminus ante quem* for the building of the monument of *2240–1870 cal BC* (*95% probability*; Fig. 6.13: *6331*), probably *2185–2180 cal BC* (*1% probability*) or *2130–1950 cal BC* (*67% probability*).[1]

The pit containing the section of tree trunk on which this measurement was made was dug into a ditch cut in sands and gravels when only part of the secondary fill had accumulated (Ellis 2004, 20). The nearest published section (Ellis 2004, fig. 14: D) indicates that at most 0.80 m of gravels, silts and clays would have accumulated by this time. It is difficult to imagine that this would have taken anything like the period of more than a thousand years which would have elapsed had the ditch originally been cut in the early fourth millennium cal BC. The monument may perhaps be seen as one of the numerous elongated earthworks of the later fourth and the third millennia cal BC, exceptional in the deposits placed in its ditch.

Two sharply rectilinear cursus monuments, one of them surrounding the 'long barrow', yielded few finds, despite being repeatedly sectioned. An antler from the base of the north cursus was unsuitable for AMS dating because of poor collagen preservation, and the only radiocarbon date relating to this monument was measured on short-life charcoal from a cremation deposit cut into the silted ditch. This provides a *terminus ante quem* of 1410–1010 cal BC (95% confidence; Fig. 6.13: NZA-14330). This dearth of dating evidence prompted sampling of both cursus monuments for dating by optically stimulated luminescence (OSL; Rhodes 2004). A single sample from the primary fill of the ditch of the north cursus provides a date of 4860–3450 BC (95% confidence; Fig. 6.13; Table 6.5: OxL-1193). This sample had good OSL characteristics and is statistically consistent with the basal date from the south cursus (Table 6.5: OxL-1188; T'=0.0; T'(5%)=3.8; ν=1; M. Allen *et al*. 2004, 65, table 17).

A series of five OSL dates were measured through the fills of the west ditch of the south cursus (Fig. 6.13; Table 6.5; M. Allen *et al*. 2004, fig. 33, table 17). These dates are in good agreement with the stratigraphic sequence ($A_{overall}$=119.7%). Modelling the results indicates a construction date for the south cursus of *4670–3550 cal BC* (*95% probability*; Fig. 6.13: *build S cursus*), probably of *4360–3800 cal BC* (*68% probability*).

These results are earlier than the radiocarbon dates currently available for ditched cursus monuments in southern Britain (Barclay and Bayliss 1999), and there are some technical issues which need to be considered when assessing the reliability of these dates.

The measurements were made on quartz grains using a Single Aliquot Regeneration (SAR) protocol (Murray and Wintle 2000), which is increasingly becoming accepted as a standard method by the luminescence community (Duller 2004). No evidence of incomplete bleaching was observed (M. Allen *et al*. 2004, 60), even though 400 single-grain measurements were made on the samples from the primary silt in the ditch of the south cursus (OxL-1188). Only one of these grains seems to have been incompletely bleached, which strongly suggests that this sediment did not contain a significant proportion of unbleached material. Rhodes (2004, 61) states that 'a relatively high water content (15±5%) has been assumed for the age calculations, reflecting the location of the samples close to the present water table in the vicinity of the Great Ouse. If the samples had been drier in the past, the ages would get slightly younger (approximately 1% younger per 1% drier)'.

These assumptions may overestimate the wetness of the area when the cursus monuments were first built. No waterlogged material is reported from the Neolithic pits, including those containing Grooved Ware, and all the waterlogged material from the 'long barrow' ditch which is reported in the publication (Robinson 2004; Clapham 2004) came from recuts, suggesting that the ditch may not initially have been waterlogged. Furthermore, the only dated recut, that containing the section of oak trunk, is of late third millennium cal BC date, leaving open the possibility that the others may be equally late. Indeed, if NZA-14465 is accurate, the ditch itself was not dug until the mid-third millennium. The cursus ditches, if they were first dug at some time in the fourth millennium, could have been dry for centuries, so that they could be of more recent date than the present calculations based on the OSL measurements suggest.

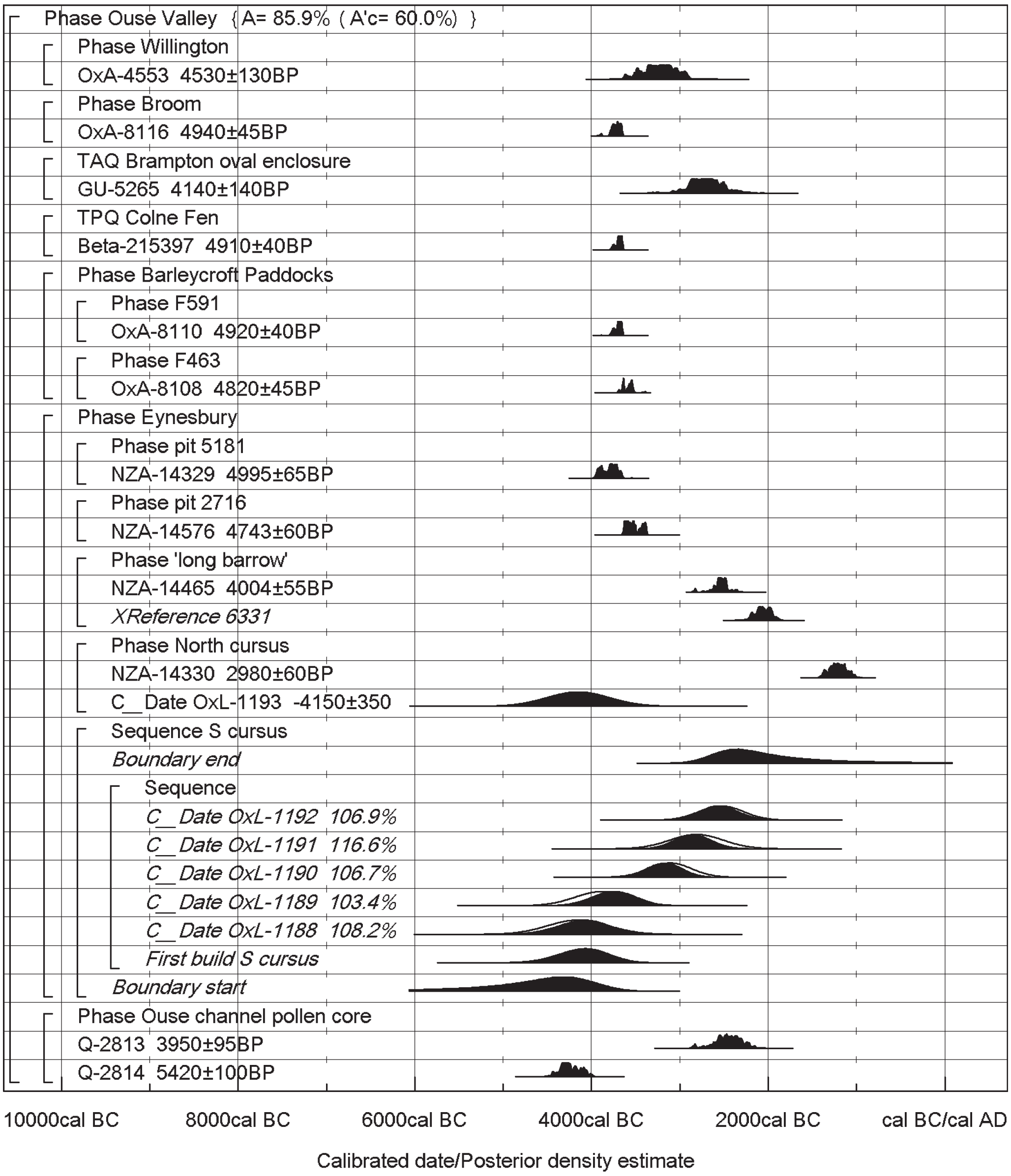


Fig. 6.13. Great Ouse catchment. Probability distributions of dates from Willington Plantation, Broom Quarry, Brampton, Colne Fen, Barleycroft Paddocks and Eynesbury; those shown in normal type have been calibrated (Stuiver and Reimer 1993), those shown in italics are modelled. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Even taking the more usual and conservative estimate of water content suggested by Rhodes (2004, 61), however, does not alter the OSL ages substantially (Fig. 6.14).

A further possibly Neolithic monument lay parallel to the 'long barrow', in the form of conjoined trapezoid and piriform enclosures, with a maximum dimension of 20 m. Finds were few, and an antler from the primary silt at the intersection of the two was unsuitable for AMS dating (Ellis 2004, 23–4).

Investigations in the Buckden/Diddington complex, downstream from Eynesbury and a little to the south of Huntingdon, have not extended to a cursus which crosses the Diddington Brook. Downstream again, at Brampton, on the Alconbury Brook just above its confluence with the Ouse, immediately to the south of Huntingdon, an elongated enclosure 90 m by 20 m, with a penannular ring ditch between its two terminals, lay immediately east of and on the same alignment as a much larger cursus (Malim 1999, 66–70; 2000, 80–3). The enclosure was poor in finds, although a *terminus ante quem* of 3085–2295 cal BC (95% confidence; Fig. 6.13: GU-5265) is provided by a sample from a pit cutting it. On the opposite side of the brook, a deposit of pottery, struck flint and a quern fragment on the base of the ditch of a two-entranced trapezoid enclosure 20 m by 14 m is provisionally described as including both plain Bowl and possibly Grooved Ware (Malim 1999, 83).

At Rectory Farm, Godmanchester, adjacent to Huntingdon, on the floodplain of the Ouse itself (Fig. 6.1), excavations in 1988–92 revealed a large trapezoid enclosure, open at its wider north-east end, measuring 336 m by 228 m, and

Table 6.5. OSL dates from the Eynesbury cursus monuments, Cambridgeshire (M. Allen et al. *2004, table 17). Posterior density estimates derive from the model defined in Fig. 6.13.*

Laboratory Number	**Context**	**Age (BC)**	***Posterior density estimate (BC) (95% probability)***
South cursus			
OxL-1188	Context 4162, 0.60 m deep. Primary fill, penultimate layer (M. Allen *et al.* 2004, fig. 33)	6150±340	*4670–3550*
OxL-1189	Context 4163, 0.50 m deep. Bank collapse (M. Allen *et al.* 2004, fig. 33)	5890±300	*4230–3270*
OxL-1190	Context 4165, 0.40 m deep. Bank collapse (M. Allen *et al.* 2004, fig. 33)	5110±240	*3580–2780*
OxL-1191	Context 4165, 0.38 m deep. Bank collapse (M. Allen *et al.* 2004, fig. 33)	4810±300	*3250–2440*
OxL-1192	Context 4166, 0.31 m deep. Secondary fill (M. Allen *et al.* 2004, fig. 33)	4530±250	*2970–2110*
North cursus			
OxL-1193	Context 3248/50, 0.50 m deep. Primary fill (Ellis 2004, fig. 5)	4150±350	

occupying more than 6 ha. It was defined by a continuous ditch which survived to some 5 m wide and 1 m deep and had been recut around part of its length. The fills indicated that there had been an internal bank. Inside the inferred site of the bank were 24 postholes, 30 to 49 m apart, lining the inner edge of the earthwork, one of them lying in the centre of its open side. The mean dimensions of their postpipes were 0.75 m by 0.63 m, conjuring up a picture of imposing, massive trunks. Finds were scant. A cursus was subsequently oriented on the enclosure, its north-east terminals cutting the south-west side of the enclosure (McAvoy 2000). Eight radiocarbon measurements were made on Neolithic samples from elements of the enclosure. Three more, on samples from pits cut into the junction of the enclosure and cursus ditches, provide *termini ante quos* for both monuments (Fig. 6.15; Table 6.4). Five charcoal, one bone and one antler sample from the enclosure were processed by the Oxford Radiocarbon Accelerator Unit using methods outlined by R. Hedges *et al*. (1989a; 1992b), and the results have been published (R. Hedges *et al*. 1991; 1993; 1995). Three samples of waterlogged wood and one of bone were processed by the Scottish Universities Research and Reactor Centre according to the methods outlined by Stenhouse and Baxter (1983). The bone sample (432-8503) produced too little carbon dioxide for conventional radiometric dating, and the CO_2 gas from its conventional combustion was sent for graphitisation and AMS measurement at the University of Arizona (AA-9569). These form part of a larger series of measurements from the site, which extends into later periods and is analysed by Bayliss *et al*. (forthcoming b).

The dating of the enclosure is problematic. Two measurements on disarticulated cattle bone from the primary silts of the two ditch terminals (AA-9569, OxA-4360) are statistically inconsistent (Table 6.4: T'=87.7; T'(5%)=3.8; ν=1). The sample for OxA-4360 was in the primary silt in one terminal; that for AA-9569 was on the surface of the primary silt in the other. For both to be accurate, the surface of the primary silts would have to have remained stable and exposed for a thousand years or so. This is implausible, especially on the gravels in which the ditch was cut. The floodplain location of the site, where waterlogged wood survived in some contexts, suggests that collagen preservation may have been variable to poor, as at Etton, Wilbraham and Haddenham, especially as three bone samples from the site which were submitted for AMS dating failed because of insufficient collagen content (English Heritage files). The sample for AA-9569 was furthermore slightly depleted in $\delta^{13}C$ compared with what would normally be expected, suggesting contamination by younger carbon. On these grounds, OxA-4360 is probably a more reliable *terminus post quem* for the excavation of the ditch.

Of the four charcoal samples from postpipes, only one, *OxA-3367*, is described as a charred post base. It is probable, however, that the remaining three were also from posts, because the sections accompanying the sample submission forms show concentrations of charcoal in clear postpipes, because the charring was a uniform occurrence around the perimeter, and because the interior of the enclosure was clean of fourth millennium cal BC occupation from which charcoal might have entered the pipes when the posts rotted (McAvoy 2000, 51). The possibility of a common taphonomy for all four samples is enhanced by the statistical consistency of the four measurements, both with each other (T'=4.1; T'(5%)=7.8; ν=3) and with *OxA-4360* (T'=7.6; T'(5%)=9.5; ν=4). None of the charcoal was identified before dating, although the dimensions of the pipes indicate that they held the trunks of mature trees. If these were oaks, the most frequently used structural timber of the period, they could have been centuries old when felled. All four are thus *termini post quos* for the construction of the post array, the most recent of them being closest to that event.

Among the measurements from postpits, as distinct from postpipes, OxA-3491, also on unidentified charcoal, is of uncertain taphonomy, and OxA-2323, measured on an antler from beside a postpipe in the fill of a postpit, could have suffered the same problems as some of the other bone samples. Both are therefore excluded from the model. Their statistical consistency (T'=1.4; T'(5%)=3.8; ν=1), however, leaves open the possibility that both resulted from a later episode of activity in which these two postpits were dug out.

Short-life samples were dated from pits cut into the south ditch of the cursus where it cut the trapezoid enclosure (*GU-5266–7*, *-5213*). These will have been close in age to their contexts and provide *termini ante quos* for the enclosure and cursus ditches which they cut. They also confirm a sequence between the pits already indicated by their contained biological remains (McAvoy 2000, 55–6).

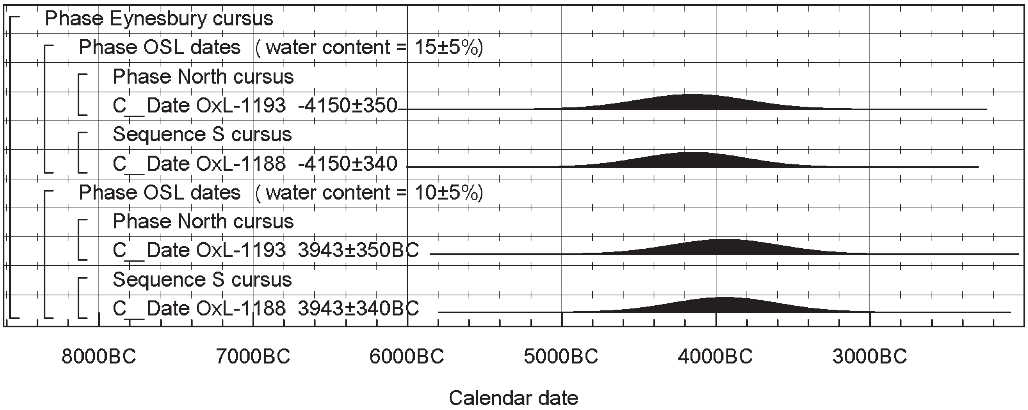


Fig. 6.14. Eynesbury. Probability distributions of OSL dates from the cursus monuments, calculated using varying estimates of water content, demonstrating the robustness of the quoted dates against variations of this assumption.

The layout of the monument (McAvoy 2000, fig. 7.1) strongly suggests that the earthwork and post array were built as a single entity. On this basis, it is estimated that the trapezoid enclosure and the post array were built in or after *3685–3365 cal BC* (*95% probability*; Fig. 6.15: *TPQ trapezoid enclosure*), probably in or after *3645–3625 cal BC* (*5% probability*) or *3610–3495 cal BC* (*46% probability*) or *3430–3375 cal BC* (*17% probability*). The construction date of the cursus can be estimated only very broadly, at *3550–2505 cal BC* (*95% probability*; Fig. 6.15: *build cursus*), or *3380–2715 cal BC* (*67% probability*) or *2705–2690 cal BC* (*1% probability*).

There is also a *terminus ante quem* of 1890–1500 cal BC (95% confidence; Table 6.4: OxA-3366) for a small trapezoid enclosure at Godmanchester (McAvoy 2000, 55, fig. 7.1), comparable with that surrounding a Neolithic burial at Grendon, Northamptonshire (Last 2005).

Downstream from Godmanchester a possible cursus at Fen Drayton would be the most fenward in the valley. Nearby are a cropmark which could be the U-plan ditch of an oval barrow, as well as early Neolithic pit clusters, one of them associated with small stake- and post-built structures (Last 1999, 90; Evans and Hodder 2006, 231, fig. 6.12).

Landscape-scale excavations in Barleycroft and Over (mentioned above) unite the area with that of the Haddenham project (Fig. 6.1). There are sporadic, small-scale early Neolithic lithic scatters and isolated pits, as well as a cluster of 18 pits associated with stake-built structures. The Mildenhall Ware from the pit cluster contrasts with the large quantities of typologically early plain Bowl pottery found with substantial lithic assemblages in two treethrow holes. The size of the assemblages and a dearth of contemporary material in the surrounding soil combine to indicate that the material was deliberately deposited and to prompt the suggestion that these features were the sites of the first acts of deposition in a still-afforested terrain, for the inhabitants of which trees would have been of all-pervading significance (C. Evans *et al*. 1999; Evans and Knight 2000; 2001; Evans and Hodder 2006, 15, 230–2, 236, 357; Garrow 2006). Single measurements on samples of charred hazelnut shell from one treehole and one pit are, however, statistically consistent (T'=2.8; T'(5%)=3.8; ν=1), and do not by themselves establish the primacy of one practice over the other (Fig. 6.13: OxA-8110, -8108).

In Colne Fen, Earith, downstream from the Barleycroft-Over area (Fig. 6.1), charcoal from a pit containing plain Bowl pottery provides a *terminus post quem* of 3775–3635 cal BC (95% confidence; Table 6.4: Beta-215397).

North of the Haddenham enclosure and on the opposite bank to Colne Fen, at least two and possibly three long barrows, which are rare in the valley, extend along a terrace of a former course of the Ouse, all emerging from the wasting peat which had preserved them (Fig. 6.1; Evans and Hodder 2006, fig. 1.2). One, 3 km north-east of the enclosure, was excavated in 1985–7 (Table 6.4, Figs 6.16–17). Test-pitting on the surrounding terrace and excavation of a gravel 'island' exposed in a nearby dyke yielded late Mesolithic and early Neolithic lithics and a small amount of plain Bowl pottery, as well as later material (Evans and Hodder 2006, 36–65). The same combination of artefacts occurred in the mound of the excavated long barrow (Knight 2006a, 161; Middleton 2006c, 170–1), suggesting that it was built on, and from, a site that had already been occupied (Evans and Hodder 2006, 190). The micromorphology of the buried soil indicated that the mound had been built in a clearing (French 2006).

The history of the Haddenham long barrow can be summarised following the excavators' phasing, in which some episodes are more confidently located than others (Evans and Hodder 2006, 99–101).

Phase I. A row of three massive posts was set up, and the easternmost of these became the centre of a post-built façade, the timbers of which cut its fills. *HAR-9176*, from one of the façade timbers, provides a *terminus post quem* for its construction. A small amount of probably human cremated bone occurred in a restricted part of a shallow linear feature filled with a mixture of soil and charcoal from large oaks (F710), and another undated spread of charcoal and cremated bone may have been contemporary (Evans and Hodder 2006, 96–7). *HAR-9171*, measured on oak charcoal associated with the F710 cremated bone, provides a *terminus post quem* for this deposit (Fig. 6.16). A light-rimmed, open, slightly carinated Bowl with fluting

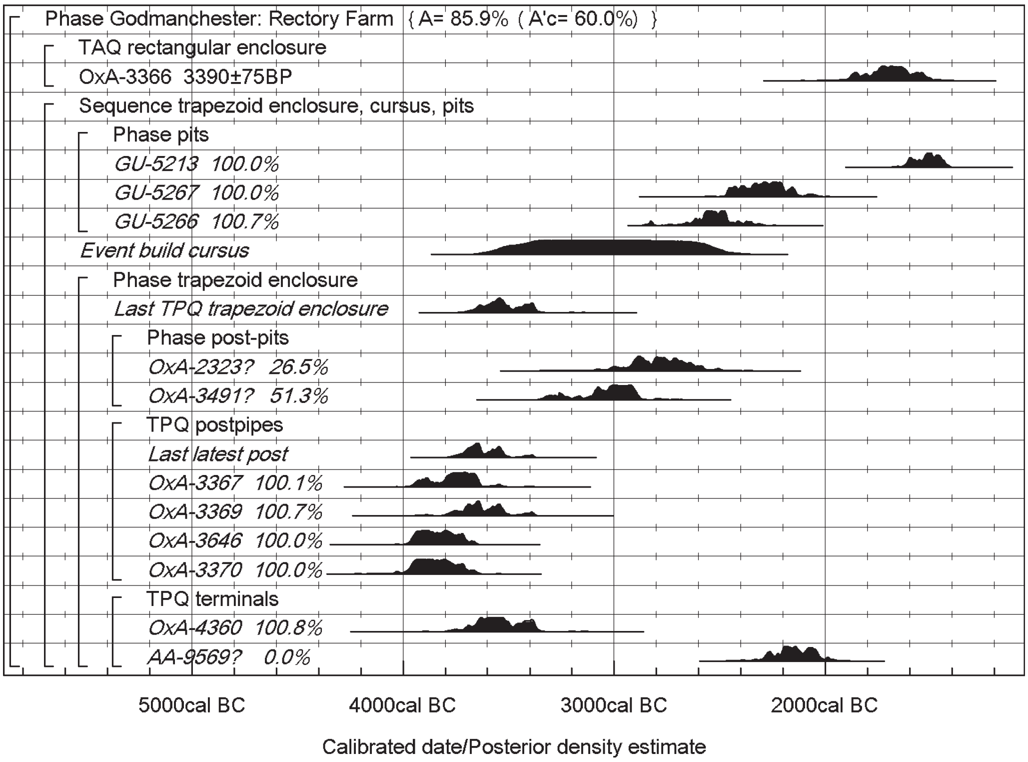


Fig. 6.15. Rectory Farm, Godmanchester. Probability distributions of dates. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

inside the rim was found complete close to a posthole of the façade (Knight 2006a, fig. 3.58: P1, fig. 3.60).

Phase II. A chamber was built of massive oak planks, set in a shallow trench. This truncated the westernmost axial posthole and was divided into proximal and distal sections by the central axial post, by then diminished in height. It was surrounded and supported by a U-plan bank, which sealed F710 and was discoloured by the eventual firing of the chamber. West-pointing 'wings' were added to each end of the façade, containing the proximal sides of a probably revetted sub-quadrangular mound of earth and turf which was built over the chamber. Gravel in the forecourt may have been laid at this stage, or, alternatively, once the ditch was dug for the later mound extension. *HAR-9173*, from a gravel lens in the forecourt, provides a *terminus post quem* for its deposition.

The badly preserved remains of at least five individuals, all at least partly articulated, were found in the distal part of the chamber, where they seemed to have been placed in an articulated state (Lee 2006). Cut marks on the distal end of one humerus have been interpreted as resulting from the detachment of muscles in the course of defleshing (Wakely 2006). The only probable grave goods in the chamber were two leaf-shaped arrowheads and a utilised flint flake (all burnt), a fragmentary pin of yew wood, and the articulated hind limb of a dog (Evans and Hodder 2006, 157–8; Middleton 2006c, 170).

The waterlogged and charred condition of the whole structure made it possible to analyse its construction and to undertake tree ring analysis (Darrah 2006; Morgan 2006a; 2006b). Several large, old oaks, up to 1.5 m in diameter and 300–400 years old had been used. The distal chamber was formed of 1 m-wide planks, placed with the exterior of the parent tree to the outside, as in a hollow tree trunk. The proximal chamber incorporated smaller planks. A 243-year floating tree-ring sequence was constructed. At least two trees were represented, one used to provide the medial and distal posts and the floor of the distal chamber, the other to provide the timbers of the proximal chamber floor as well as a plank found on the floor of the distal chamber. The first may have been felled some decades before the second, although the absence of sapwood makes certainty impossible. The condition of the roof timbers made cross-matching difficult, but at least some of them were from trees felled at about the time of the construction of the distal chamber.

Unfortunately, the master tree ring chronology from the barrow does not cross-match with the reference chronologies currently available, so that these timbers remain undated by dendrochronology. A series of five bi-decadal samples from the floating tree ring chronology were submitted for high-precision radiocarbon dating at the Queen's University, Belfast (UB-3167–71). These were processed to holocellulose and dated by LSC as described by Pearson (1984). The outermost sample (UB-3171) spanned a bidecade centred on relative year 230, and so needs to be offset by an additional 13 years to reach the last measured ring of the sequence. The wiggle-match for this sequence is shown in Fig. 6.17. None of the timbers at Haddenham, however, had surviving sapwood. The last measured ring has therefore been shifted by the probability distribution of the number of sapwood rings present in

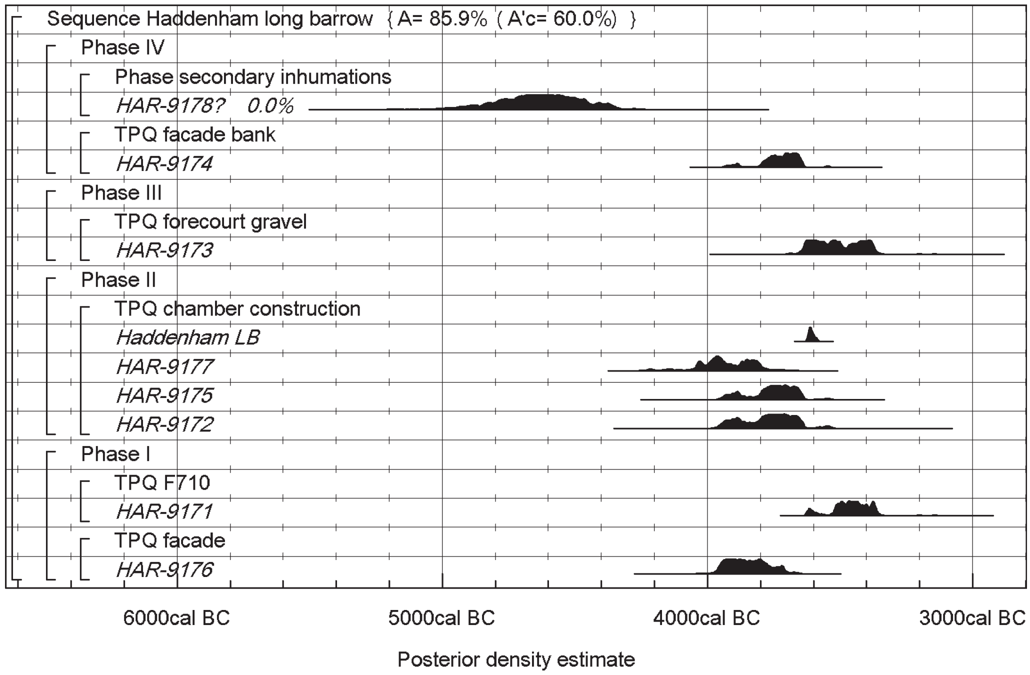


Fig. 6.16. Haddenham long barrow. Probability distributions of dates. The distribution 'Haddenham LB' is the last measured ring derived from the wiggle-match shown in Fig. 6.17, offset by the probability distribution of the number of sapwood rings expected for English oak (Bayliss and Tyers 2004, fig. 3). The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

English oak (Bayliss and Tyers 2004, fig. 3) to provide a *terminus post quem* for the construction of the timber chamber. This distribution (*Haddenham LB*) has been incorporated in the overall model of the chronology of the barrow (Fig. 6.16).

HAR-9177, -9172 and -9175, measured on samples from other timbers of the mortuary structure, also provide *termini post quos* for the construction of the chamber.

Phase III. After turf had formed on it, the initial phase II mound was heightened and extended westward into a trapezoid form, the higher, longer mound being built with material from a surrounding ditch. A timber hornwork, revetting newly built forebanks, was constructed at the centre of the façade and became a focus for deposition, the chamber remaining accessible through the centre of the façade.

Eventually the easternmost proximal axial post was removed from the chamber and a mound of turf was built in the proximal chamber and the adjacent part of the distal one, overlying the truncated stump of the central axial post. The chamber was fired, smouldering slowly as if in a clamp (Evans and Hodder 2006, 130–40), and it was closed by the insertion of additional façade posts. Sherds from a decorated Mildenhall style Bowl were scattered within the arms of the hornwork, in front of the blocked entrance, the only area in which decorated pottery was found (Knight 2006b, fig. 3.58: P2, fig. 3.60).

Phase IV. A bank was built across the front of the façade, built of scorched soil and gravel with charred oak fragments and large oak timbers, probably derived from the burning and dismantling of the façade; a hollow in the top of the mound caused by the collapse of the chamber was infilled; burials were inserted into the body of the mound; and pits were dug into the mound and ditch. *HAR-9174* provides a *terminus post quem* for the façade bank. HAR-9178 resulted from an unsuccessful attempt to date one of the secondary burials in the mound. The sample suffered from the same collagen deficiency as bone samples from the Haddenham enclosure. For this reason, the measurement is excluded from the analysis, since it is almost certainly contaminated.

The overall model for the chronology of the Haddenham long barrow is shown in Fig. 6.16. Strictly, all the available samples provide only *termini post quos* for the structure. The most reliable estimate for the construction of the timber chamber is provided by the *terminus post quem* for the felling of the timbers included in the dendrochronological site master chronology. This provides a *terminus post quem* for phase II construction of *3630–3580 cal BC* (*95% probability*; Fig. 6.16: *Haddenham LB*), probably of *3625–3600 cal BC* (*68% probability*). We do not know how many heartwood rings may have been missing from these tree ring samples, although Morgan (2006b, 186), using a very similar analysis, suggested that the horizontal timbers were felled in the first half of the 36th century cal BC. If we assume that only sapwood was missing from the timber dated by *UB-3167–71*, then a model which constrains *Haddenham LB* to be later than *HAR-9171* from F710 shows good overall agreement ($A_{overall}$=73.7%), so it is at least possible that *Haddenham LB* is in fact close to the date of construction of the chamber.

The later use of the monument is poorly dated. *HAR-9173* provides a *terminus post quem* for the extension of the barrow of *3655–3355 cal BC* (*95% probability*; Fig.

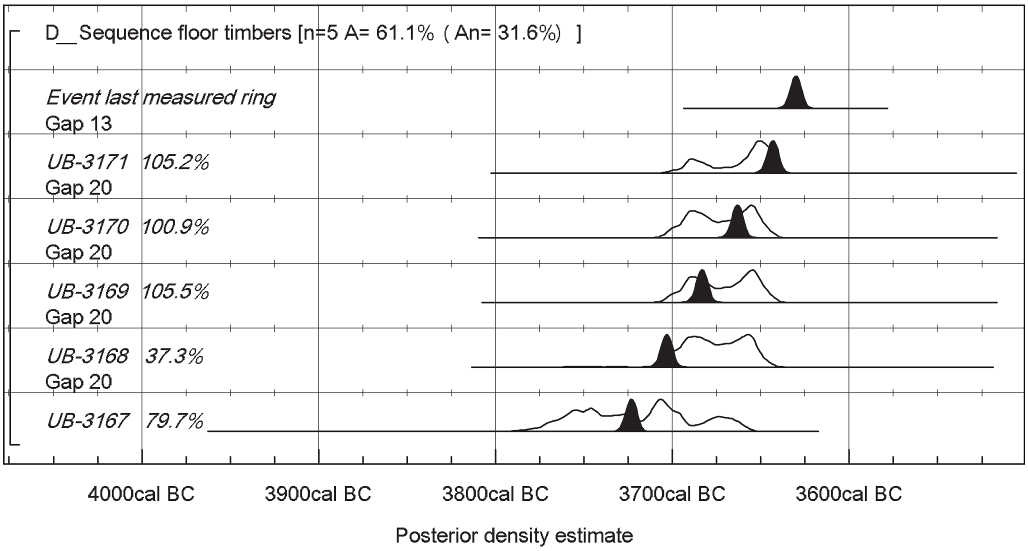


Fig. 6.17. Haddenham long barrow. Probability distributions of dates from the floating tree-ring sequence. The format is identical to that of Fig. 6.4. The large square bracket down the left-hand side of the diagram, along with the OxCal keywords, defines the overall model exactly.

6.16: *HAR-9173*), probably of *3635–3550 cal BC* (*30% probability*) or *3540–3495 cal BC* (*16% probability*) or *3435–3375 cal BC* (*22% probability*). This does not provide much indication of the period during which the monument was in use.

Below Haddenham, the Ouse enters the fenland basin (Fig. 6.1), where early Neolithic scatters abound, especially in the south-east (Hall and Coles 1994, 41–5), although they are often swamped by the larger spreads of later material. One of the most thoroughly investigated, on Honey Hill, Ramsey, in the south-west of the basin, is interpreted as reflecting only certain stages in the collection of raw material, its transport to and working on the hill, and the removal of some of it elsewhere (Edmonds *et al*. 1999, 53). This emphasises the interconnectedness of different points in the landscape, and the potential brevity of single episodes of activity at a particular location. Brevity is also apparent to the east, in the early Neolithic occupation of Peacock’s Farm, where a very small quantity of early Neolithic material was deposited with minimal concomitant impact on the by then regenerated forest cover and with no ‘black band’, in contrast to the underlying Mesolithic occupation (Clark and Godwin 1962, 15–19; A. Smith *et al*. 1989, 218).

The date of that early Neolithic episode is known only approximately. Taken alone, two statistically consistent measurements on unidentified bulk charcoal samples from the scatter of material extending into the peat (Table 6.4: *Q-525/6*, *-527/8*; T'=0.2; T'(5%)=3.8; ν=1) should provide *termini post quos* for it, as may another statistically consistent measurement made in the 1980s on a bulk sample of disarticulated deer bone (Table 6.4: *CAR-790*; T'=0.5; T'(5%)=6.0; ν=2). These are, however, more recent measurements made in the early 1960s on peat samples from the base and top of the Neolithic layer (Table 6.4: *Q-584,* -583). The discrepancy was noted at the time, but not resolved (Godwin and Willis 1961, 71–2; Clark and Godwin 1962, 20). In our view, the most plausible explanation for the poor agreement between some of the dates on bulk peat samples from Peacock’s Farm and the stratigraphic sequence is that some samples contained reworked peat. Specifically, Q-581–3 and CAR-1103 have been excluded from the model on this basis. We do not believe that the discrepancy can be explained on the basis of inter-laboratory offsets, since both the sequences of sediment samples above the Neolithic occupation (Fig. 6.18: Sequence Q and Sequence CAR2) include dates which do not conform to their relative stratigraphic positions. An additional reason is that the results relating here to the elm decline from the two laboratories, each set run as a series at one time, are consistent (Table 6.4: CAR-1096 and Q-585; T'=2.1; T'(5%)=3.8; ν=1). Although the three samples from the Neolithic occupation at Peacock’s Farm strictly provide *termini post quos* for this activity, their statistical consistency may suggest that none of the samples contained substantially redeposited or otherwise old material, and the occupation could have been a very brief episode indeed. This activity occurred in *3950–3655 cal BC* (*95% probability*; e.g. Fig. 6.18: *CAR-790*), probably in *3935–3875 cal BC* (*19% probability*) or *3805–3690 cal BC* (*49% probability*).

Test pitting on and beyond another sand ridge at Letter F Farm, Littleport, 2.5 km north-west of Peacock’s Farm, yielded Mesolithic and early Neolithic lithics which extended off the ridge into the lower peat and over the surface of the underlying sand accompanied by abundant charcoal, apparently derived from the same occupation. Bulk samples of this have provided *termini post quos* in the late fifth and early fourth millennium cal BC (Table 6.4: CAR-376, -378–80). The third millennium cal BC date of CAR-377 has not been explained (A. Smith *et al*. 1989, 228–36).

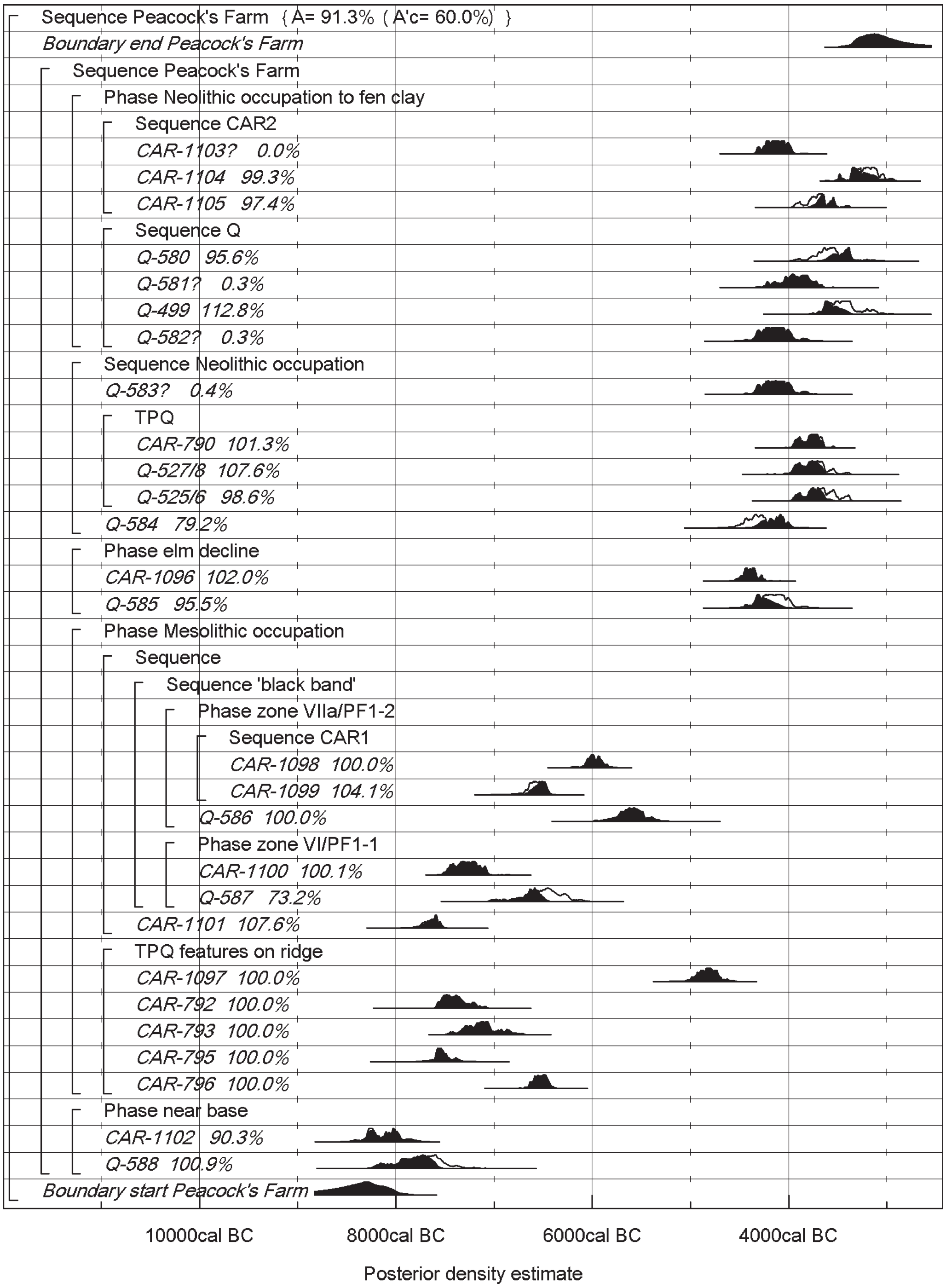


Fig. 6.18. Peacock's Farm, Shippea Hill. Probability distributions of dates. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Peacock's Farm is exceptional in the basin in that the pottery from the Neolithic level consists of fragments of plain, light-rimmed, hollow-necked Bowls, like the ceramics from the treeholes at Barleycroft Farm and a vessel from Hayland House, Mildenhall, Suffolk (Leaf 1934), whereas most of the Bowl pottery from the islands and fringes of the basin is either indeterminate or has the heavy rims and sometimes the decoration characteristic of Mildenhall Ware (Healy 1991, 128–9; 1996, 99, 106).

It is also exceptional in that, while there are Mesolithic and early Neolithic artefacts on hundreds of hillocks in the basin (Hall and Coles 1994, chapters 3–4), it is, because of relatively late peat growth outside the river channels, one of few known locations where the pollen record goes back to the Mesolithic and early Neolithic, and one of even fewer where that record can be related to human activity. The Great Ouse palaeochannel at Haddenham (Evans and Hodder 2006, fig. 2.1), already mentioned, is another, and the contrast in the Neolithic between the two locations is striking. At Peacock's Farm in the southern basin,

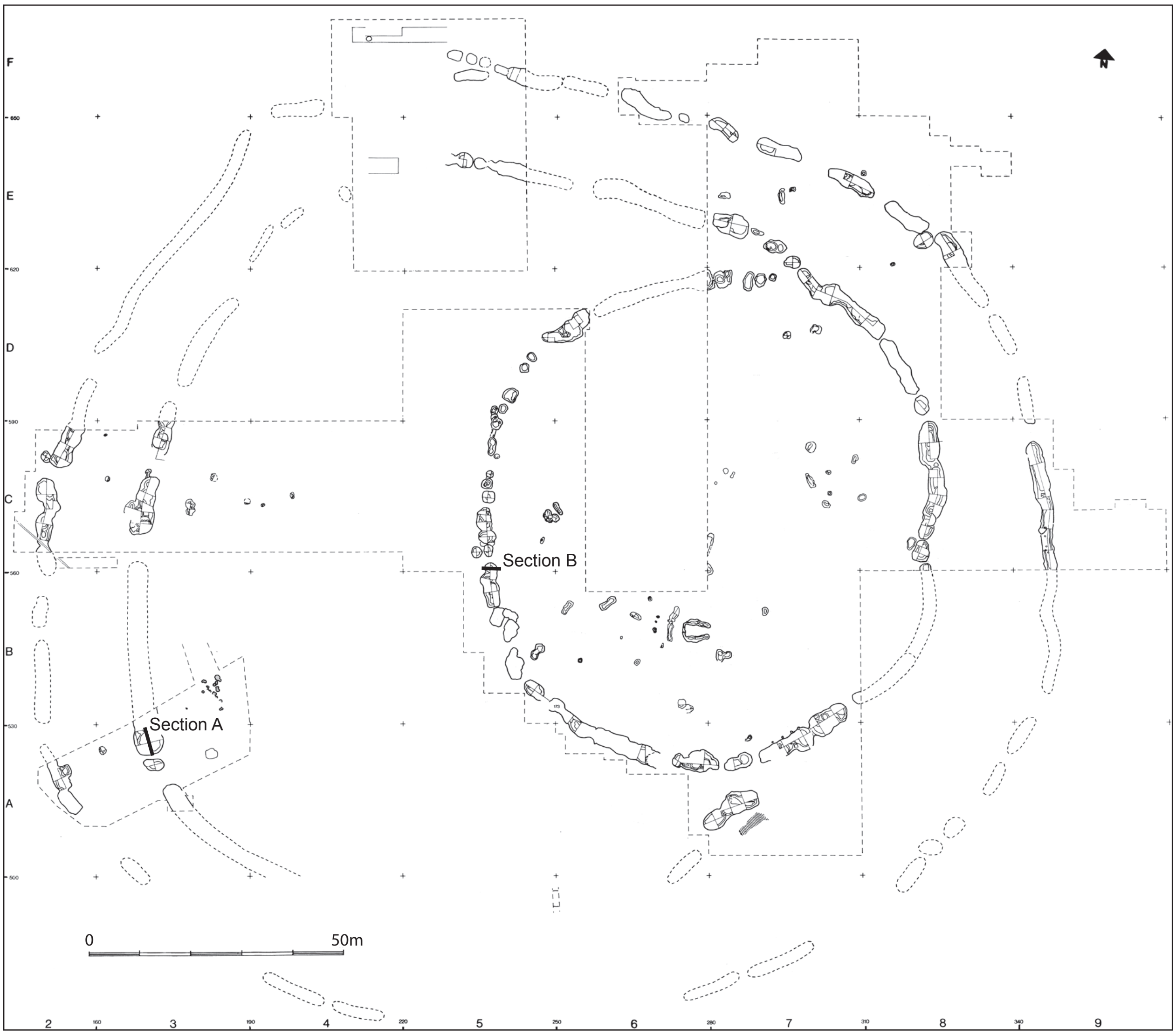


Fig. 6.19. Briar Hill. Plan showing Neolithic and Bronze Age features and location of illustrated sections, after Bamford (1985, back pocket).

the Neolithic presence was marked by a small quantity of artefacts and no break in the woodland cover; on the terraces of the Ouse in the Haddenham area, clearance and cultivation began before the excavated long barrow was built and seem to have continued for hundreds of years. This may, as Martyn Waller suggests (1994, 105), reflect the proximity of large tracts of dry, cultivable land on the terraces. It may also, at least in part, reflect the repeated frequentation of the area of the largest causewayed enclosure and the greatest concentration of long barrows in and around the basin, even though the excavators argue for relatively short use of the enclosure and for the involvement of a comparatively small community (Evans and Hodder 2006, chapter 5).

Finally, in contrast, we still know little of the wider context in which Great Wilbraham was set. Local environment has been outlined above, and possible elements of the local catchment (with a 5-km radius) have been discussed in some detail (C. Evans *et al*. 2006, 152–9, figs 22 and 24, below), but the broader setting is less well researched (C. Evans *et al*. 2006, fig. 24, top). At Landbeach, in the valley of the Cam itself some 10 km to the north-west, a cropmark of four segments of a causewayed ditch may be part of a further enclosure (Oswald *et al*. 2001, 150). A continuous elongated enclosure on the Chalk ridge at Swaffham Prior a few kilometres to the north-east has been classed by some with long barrows (Taylor 1981, 109; Evans and Hodder 2006, 195, fig. 3.73).

6.3 The Nene valley

6.3.1 Briar Hill, Northampton, SP 7362 5923

Location and topography

The enclosure at Briar Hill lies at 80 m OD on Northampton Sand with Ironstone, on a north-facing slope overlooking and intervisible with the Nene valley (Fig. 6.1; Oswald *et al*. 2001, fig. 5.20). The surrounding fields have yielded a

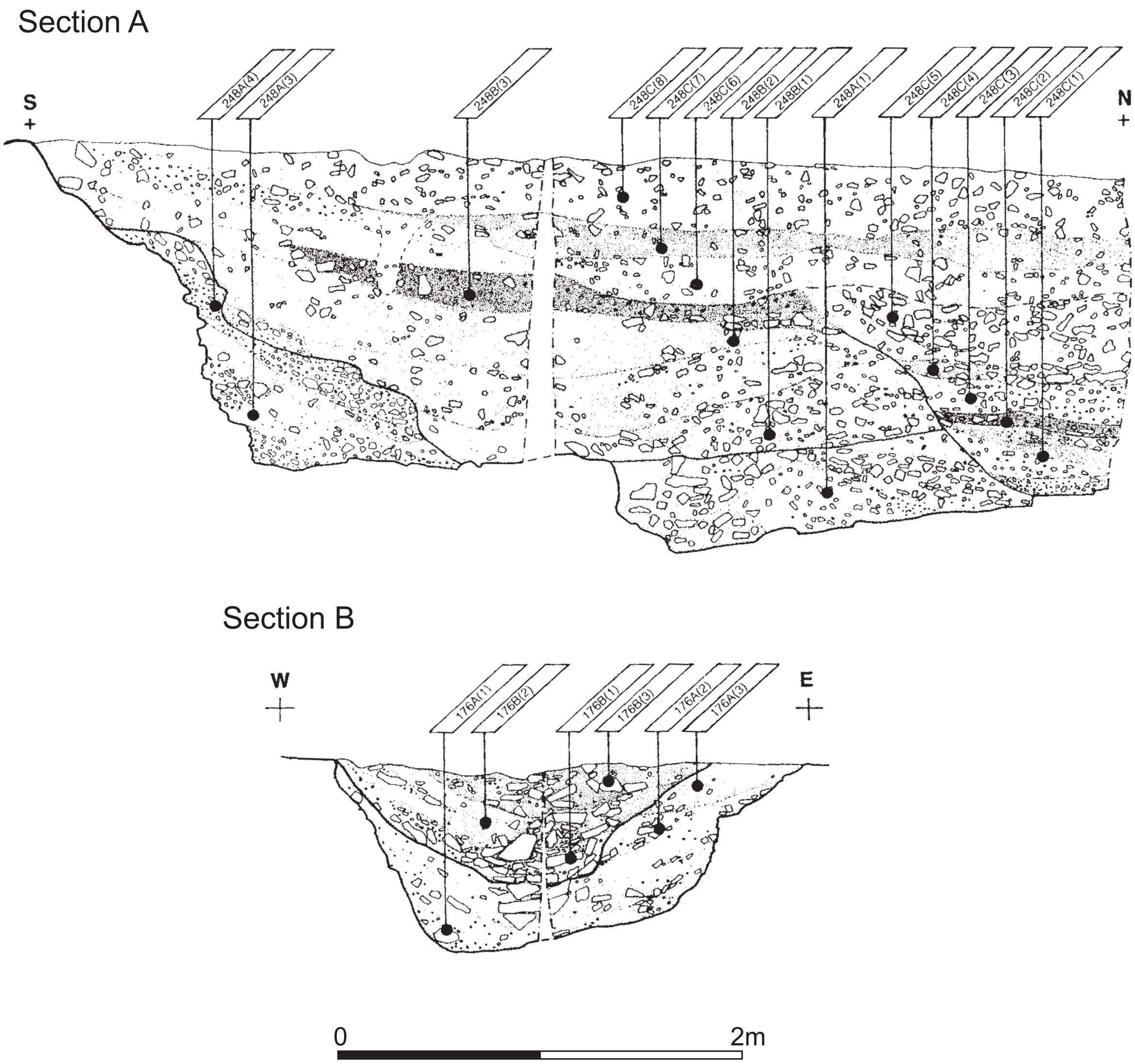


Fig. 6.20. Briar Hill. Longitudinal section of south butt of segment 248 of the inner ditch and transverse section of segment 176 of spiral ditch, after Bamford (1985, figs 11:2, 15:1).

lithic collection of several thousand pieces, ranging from Mesolithic to Bronze Age in date (Bamford 1985, 1–2). In the Nene valley, this is a typical location for lithic scatters, which are concentrated on this geology (Hall 1985, 30–43; Hall and Hutchings 1972), as if it was a zone favoured for occupation, while Neolithic monuments other than causewayed enclosures tend, like the Early Bronze Age round barrows which line the valley, to lie below the settled area, on terraces just above the valley bottom (Harding and Healy 2007). One of the largest scatters occupies the opposite side of the valley at Duston (Bamford 1985, 5). Beyond that, on a hilltop some 4 km north of Briar Hill, is a second causewayed enclosure at Dallington, confirmed as such by evaluation (Keevill 1992; Oswald *et al*. 2001, fig. 3.4).

The sub-circular Briar Hill enclosure covered some 3 ha and had a maximum dimension of 162 m and consisted of concentric outer and inner ditches 15–28 m apart, with a further circuit formed by the eastern arc of the inner ditch and a 'spiral' extension which together formed an inner enclosure (Fig. 6.19). The relationship between the inner and spiral ditches remains unclear. There were relatively few internal features contemporary with the enclosure.

History of investigation

The enclosure at Briar Hill was discovered by aerial photography in 1972, and excavated in 1974–8 by the Archaeological Unit of the Northampton Development Corporation, under the direction of Helen Bamford, in advance of house building. In addition to a Neolithic causewayed enclosure, the excavation found later Neolithic features, a Middle Bronze Age cremation cemetery, Iron Age rectilinear enclosures and pits, Roman pits, Saxon sunken-featured buildings and medieval and post-medieval furrows (Bamford 1985, 1–7). Possible entrances are marked by wider causeways and particularly wide and deep segments with out-turned butts. More than a third of the inner ditch and 'spiral' extension (38%) was excavated, together with a smaller proportion (13%) of the outer ditch, together with more than 75% of the inner enclosure and

30% of the area between it and the outer ditch (Bamford 1985, 6). Each circuit was made up of many short segments, typically 1–2 m deep and up to 5 m long, except for those in the west and north of the spiral ditch, where segments were shorter and as little as 1 m deep. All three ditches had undergone repeated recutting, generally becoming half to two-thirds silted between episodes (Bamford 1985, 32–3), which had had the effect of linking what had originally been ovoid pits into segments of increasing length (Bamford 1985, figs 62–4). As a result, a single segment presented a bewildering succession of cuts, rendered difficult to identify by the soils of the site (Bamford 1985, 7), and with high potential for redeposition (Fig. 6.20). The fill patterns indicated that the outer and inner ditches had internal banks and that the inner enclosure formed by the spiral ditch and the eastern arc of the inner ditch had an external bank (Bamford 1985, fig. 20). Very few features in the interior could have been contemporary with the enclosure, most belonging to subsequently built timber structures, some of them associated with Grooved Ware (Bamford 1985, 44). Pits and postholes were cut into the top of the silted inner ditch during the currency of both Peterborough Ware and Beaker and were concentrated in the area of a probable western entrance (Bamford 1985, 47, fig. 64).

Very little unburnt bone survived on the site. Durable finds were concentrated in all levels of the spiral ditch, especially in the smaller, shallower segments of its north-western arc, where they were at their densest in deposits of burnt material (Bamford 1985, 59–60, tables 3:1–4, fig. 31), and unstratified lithics were concentrated within the inner enclosure formed by the spiral ditch and the eastern arc of the inner ditch (Bamford 1985, figs 31–2). The pottery from all but the highest levels in the ditches conforms to the Mildenhall style, but has a low incidence of decoration (Bamford 1985, figs 52–5). Only one exceptionally fine vessel was made in a non-local fabric (Bamford 1985, 109). Small quantities of Peterborough Ware (notably Fengate Ware in an upper fill of one segment of the inner ditch), Grooved Ware and Beaker were also present. The flint industry was broadly comparable with others of the period. Axeheads were made of a different flint from the rest of the industry (Bamford 1985, 60). Salient features included three clusters of material from single knapping events, each possibly from a single nodule or cobble and including refits, in one of the final recuts of the spiral ditch, in one of the final recuts of the inner ditch, and in a segment of the outer ditch (Bamford 1985, 78). Beyond these, there was little sign of careful placement of objects (Bamford 1985, 133), although the concentration of artefacts in part of the spiral ditch and the recurrence of artefact-rich tips of burnt material both suggest deliberate deposition. Stone axehead fragments from the site were principally of group VI, with others of groups I, VII and XX (Bamford 1985, 92). Grinding equipment was of local rocks (Bamford 1985, 93). The overall density of artefacts is low compared with those at causewayed enclosures farther south (Bamford 1985, 134, table 14; C. Evans *et al*. 2006, table 12).

Previous dating

Twenty-three bulk charcoal samples, most of them from prehistoric features, were dated at the AERE Harwell Isotope Measurements Laboratory in 1978–82 (Table 6.6; Walker and Otlet 1985). Charcoal, which was the only material available for dating, was not abundant, and all charcoal samples from the ditch fills appear to have been considered for dating. Fifteen were taken from ditch deposits and features cutting them and, except for HAR-4092, were from 'well defined, clearly stratified deposits; usually the distinctive 'ashy' or burnt deposits in the ditch fills' (Bamford 1985, 40).

All but HAR-4110, -5125, -5216a and b, and -5271 were pretreated by the AAA method (Mook and Streurman 1983, 48–9) and dated by LSC, as described by Otlet and Polach (1990). The five remaining samples were converted to carbon dioxide following pretreatment and dated in Harwell's miniature gas counter, which had only recently been introduced (Otlet and Evans 1983). Radon gas was encountered in some small counter samples in this period and could have resulted in misleadingly young measurements. It is not known if any of the Briar Hill samples were affected, although it is noteworthy that three of them yielded results that were more recent than expected (Bamford 1985, table 27; Meadows 2003, 6–7).

The results were interpreted on the premises that the whole complex had be laid out and built at one time, on the evidence of its plan, and that the similarity of the sequences of recutting in each ditch segment reflected a series of major reinstatements of the whole earthwork rather than piecemeal reworking (Bamford 1985, 39). On this basis, each deposit in each segment of each ditch could be fitted into a single system of phasing, from I (marking out of circuits) to IX (later Neolithic; Bamford 1985, figs 5, 62–4). HAR-4110, -5125 and -5216 (three of the four small counter dates) were excluded as inconsistent with the early stratigraphic positions of the samples. The remaining measurements were seen as indicating that the complex was built *c.* 4480 cal BC, was finally recut in *c.* 3380 cal BC, and continued to be frequented, with the addition of new structures and features, to *c.* 2140 cal BC (Bamford 1985, 40–4).

The assumption of unitary plan and construction was questioned by Chris Evans (1988b, 85–6) on the grounds that the plan reflected modification and accretion; and by Roger Mercer (1990, 63–4), who suggested that the almost circular enclosure defined by the spiral ditch was a later modification analogous to henge monuments. The entire scheme was criticised far more radically by Ian Kinnes and Nick Thorpe (1986), on the grounds that: the three measurements on which the early construction date was based were from diverse and unrelated contexts (HAR-4072 from a postpit in uncertain relation to the outer ditch; HAR-2282 from a layer just above the initial fill of the inner ditch; and HAR-4092 from an upper fill of another segment of the same ditch, in which it was thought to have been redeposited); these dates were outliers from the others, which clustered in the periods *c.* 3640–2660 and 2660–1690

Table 6.6. Radiocarbon dates from Briar Hill, Northamptonshire. Posterior density estimates derive from the model defined in Fig. 6.23.

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)* Model 2, Fig. 6.23
Outer ditch								
HAR-2282	P76 E8 077	Bulk sample, mainly of *Quercus* charcoal, with some Pomoideae	Fill 77A (2). Tip of dark sand with charcoal, sherds and struck flint overlying primary accumulation at E end of segment (Bamford 1985, microfiche appendix 2 SE8/28)	5440±110	−24.4		4500–3990	*4490–4035* (*94%*) or *4020–3995* (*1%*)
HAR-4072	P76 C2 011	Bulk sample of *Quercus* charcoal	Feature 219. Posthole cut by recut of outer ditch segment 197, beside probable entrance (Bamford 1985, fig. 7:1)	5680±70	−26.5		4710–4350	*4690–4365*
Inner ditch								
HAR-3208	P76 D7 083	Bulk sample of *Prunus* and unidentified charcoal	Feature 52. Adult cremation deposit in base of penultimate recut in segment 38 (Bamford 1985, fig. 9:2)	4600±90	−24.5		3640–3020	*3540–3085*
HAR-4071	P76 C3 116	Mature *Prunus* charcoal	Fill 199D (2). Fill of final recut (Bamford 1985, microfiche 129)	4610±90	−26.1		3640–3020	*3540–3090*
*HAR-5271	P76 C8 330	Bulk sample of *Corylus* sp., *Alnus* sp., *Alnus* sp./*Corylus* sp., and unidentified charcoal	Fill 28C (2). Small tip or dump of discoloured sand containing charcoal and heat-reddened ironstone. First or second major recut of segment (Bamford 1985, 36)	4780±120	−26.1		3800–3340	*3720–3360*
HAR-4075	P76 A7 185	Bulk sample of mature *Prunus* charcoal	Fill 124E (3). Small tip or dump of discoloured sand containing charcoal and heat-reddened ironstone. Second fill from bottom fill of final recut of segment, containing 11 sherds in Neolithic Bowl fabrics (Bamford 1985, 36, fig. 16.2, appendix 7:2)	4660±70	−25.2		3640–3130	*3630–3550* (*4%*) or *3545–3315* (*86%*) or *3220–3175* (*3%*) or *3160–3120* (*2%*)
*HAR-4110	P76 C3 275	Bulk sample of mature *Quercus* charcoal	Fill 251B (6). Fill of second cut of main inner ditch segment 192/251 (Bamford 1985, fig. 8:2). Stratified below HAR-4073	3410±100	−27.3		1960–1460	
HAR-5217	P76 A3 021	Bulk sample of unidentified charcoal	Fill 248C (2). Small tip or dump of discoloured sand containing charcoal and heat-reddened ironstone. One of lower fills of final or penultimate recut in segment (Bamford 1985, 36, fig. 11:2). In uncertain relation to 248B (3), the context of HAR-4066	4420±90	−26.3		3370–2880	*3495–3465* (*3%*) or *3375–2930* (*92%*)
HAR-4066	P76 A3 020	Bulk sample of *Quercus*, *Corylus*, *Prunus* and Pomoideae charcoal	Fill 248B (3). Layer of dark sand and charcoal with much struck flint and some pottery, extending across segment, containing 8 sherds in Neolithic Bowl fabrics. In uncertain relation to 248C (2), the context of HAR-5217 (Bamford 1985, 36, fig. 11:2, fig. 53: NP29, 30, appendix 7:2). Ascribed by Bamford to phase VIII on the evidence of its radiocarbon date rather than its stratigraphic position	4080±70	−26.9		2880–2460	
Spiral ditch								
HAR-4092	P76 A6 051	Bulk sample of *Quercus*, *Fraxinus*, *Prunus* and Pomoideae charcoal	Fill 128E (4). Penultimate fill of final recut of segment (Bamford 1985, fig. 14:2)	5540±140	−24.2		4710–4040	*4690–4045*

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* *(95% probability)* **Model 2, Fig. 6.23**
*HAR-5125	P76 D6 095	Bulk sample of Pomoideae and unidentified charcoal	Fill 165B (1). Fill of 2nd cut of segment (Bamford 1985, fig. 13:2)	3900±90	−27.1		2620–2130	
*HAR-5216a	P76 C5 241	Bulk sample of *Quercus* sp. and unidentified charcoal. Remainder identified 2005 by Rowena Gale as 1 fragment *Quercus* sp. sapwood plus *Quercus* heartwood of wood of undetermined maturity. From the same find as HAR-5216b	Fill 176A (1). Initial fill of primary cut of segment (Bamford 1985, fig. 15:1)	4130±150	−25.0 (assumed)	4370±83 T'=3.5; T'(5%)=3.8; ν=1	3350–2870	
*HAR-5216b	P76 C5 241	From the same find as HAR-5216a	From the same context as HAR-5216a	4470±100	−25.0 (assumed)			
Interior								
HAR-4074	P76 B6 047	Bulk sample of *Quercus*, hazel, alder blackthorn charcoal	Feature 137. Pit containing struck flint and Neolithic pottery	4370±80	−25.2		3340–2870	
HAR-4057	P7L B5 116	Bulk sample of *Quercus* charcoal	Feature 218. Large postpit, latest in a sequence of 4, on spatial grounds part of same triangular layout as 218 (Bamford 1985, 44, fig. 23). Layer with charcoal appears tipped into partly silted socket rather than to have been burnt post	4250±70	−27.7		3020–2630	
HAR-2625	R76 B7 390	Bulk sample of *Quercus* charcoal	Feature 156. Large postpit, latest in a sequence of 4, on spatial grounds part of same triangular layout as 218 (Bamford 1985, 44, fig. 23). Layer with charcoal appears tipped into partly silted socket rather than to have been burnt post	4290±80	−30.4		3100–2670	
HAR-2607	P76 B6 060	Bulk sample of *Quercus*, *Corylus/Alnus*, *Salix/Populus* and *Prunus* charcoal	Feature 145. Horseshoe-plan timber structure with Grooved Ware (Bamford 1985, 44, pl. 12, fig. 22	4010±90	−25.2		2880–2280	
Pits cutting inner ditch								
HAR-4089	P76 C3 335	Bulk sample of mature *Quercus* charcoal	Feature 258. Pit cutting inner ditch segment 192/251	3620±90	−25.7		2280–1740	
HAR-4073	P76 C3 503	Bulk sample of mature *Quercus* charcoal	Feature 303. Pit cutting inner ditch segment 192/251 (?) (Bamford 1985, fig. 8:2). Stratified above HAR-4110	3790±100	−27.8		2490–1930	
HAR-4067	P76 C3 25	Bulk sample of mature *Quercus* charcoal	Feature 228A. Pit cutting inner ditch segment 192/251 near top of sequence, itself cut by subsequent pits (Bamford 1985, fig. 8:2)	3730±70	−27.0		2350–1930	
HAR-2284	P76 E7 041	Bulk sample of *Quercus, Alnus, Corylus* and Pomoideae charcoal. From the same find as HAR-2389	Feature 337. Pit cutting inner ditch segment 41 and containing ?Beaker and indeterminate sherds (Bamford 1985, 47. fig. 10:2)	3460±120	−25.2	3511±72 T'=0.3; T'(5%)=3.8; ν=1	2030– 1640	
HAR-2389	P76 E7 041	Bulk charcoal sample from the same find as HAR-2284	From the same context as HAR-2284	3540±90	−25.5			
Cremations								
HAR-4058	P76 B3 001	Bulk sample of unidentified charcoal	Feature 240. Adult ?male cremation burial accompanied by calcined tanged arrowhead, within outer ditch (Bamford 1985, 47–9, pl. 13, fig. 25	3700±150	−26.0		2560–1690	
HAR-4065	P76 B3 168	Bulk charcoal sample, probably all of *Quercus* sp. heartwood, but fragments too small to verify	Feature 275. Fill around Bucket Urn containing adult cremation burial, within outer ditch	3180±70	−27.1		1620–1300	

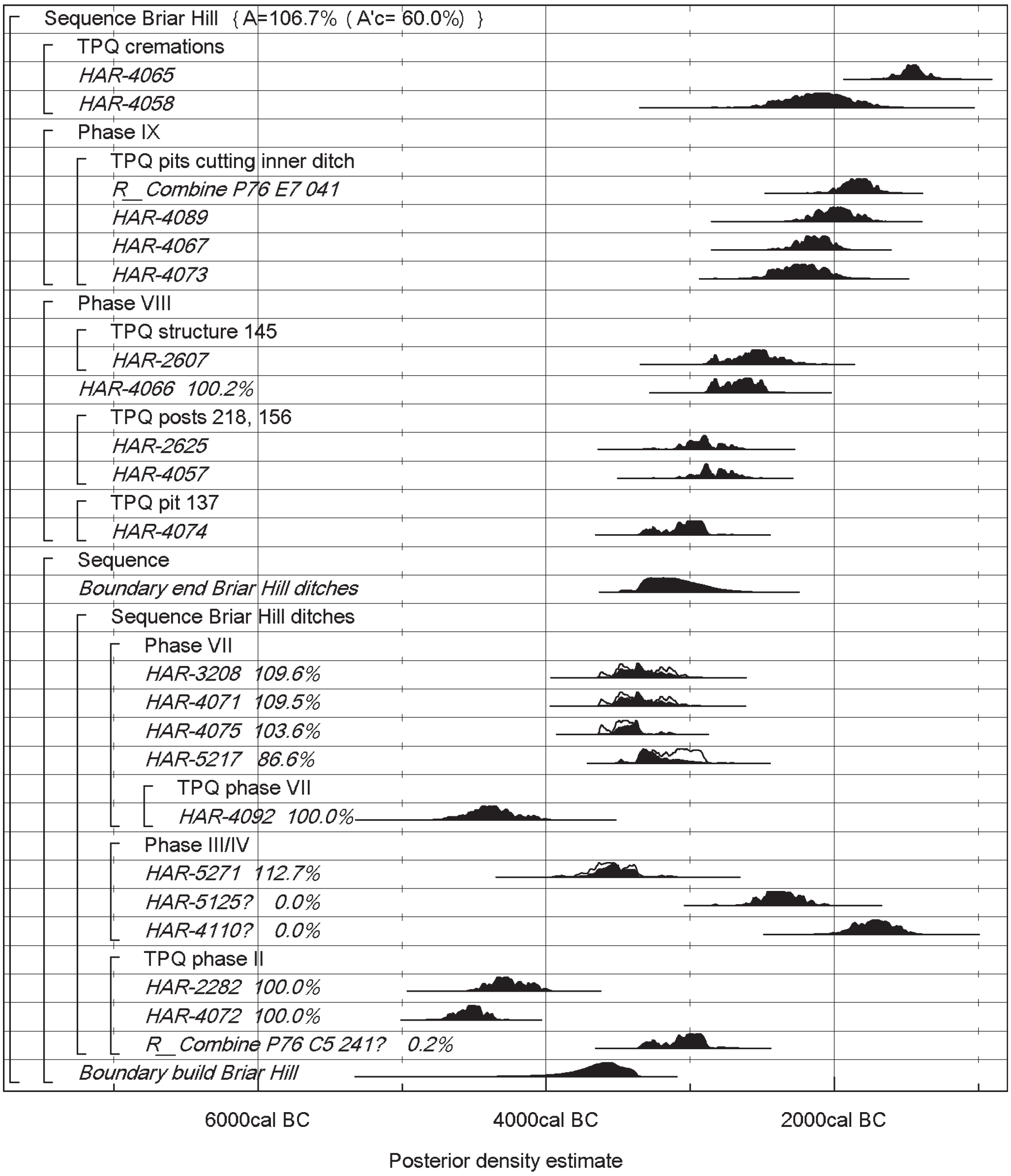


Fig. 6.21. Briar Hill. Probability distributions of dates, incorporating the phasing proposed by Bamford (1985). The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

cal BC; the artefacts from the site accorded with the two main clusters of dates; and the composition of the samples left open the possibility of age offsets.

Reassessment of previous dating

Thorough reassessment of the existing dates in the light of scientific advances made over the past 20 years (Meadows 2003) has made it possible to reinterpret these results. A chronological model integrating the calibrated radiocarbon dates with the original phasing scheme is shown in Fig. 6.21. Although all the bulk charcoal samples could have been of heterogeneous origin, those consisting entirely of short-lived species are here treated as potentially reliable and those consisting of unidentified charcoal or consisting of or including long-lived species are treated as *termini post quos* unless they are statistically consistent with measurements made on short-lived species. Thus all three earliest dates (*HAR-2282, -4072* and *-4092*), which were the foundation for the suggested fifth millennium cal BC construction date, are treated as *termini post quos*. The samples for these may have included not only mature wood but also redeposited charcoal, especially as there was a later Mesolithic presence on the site (Bamford 1985, 76, fig. 45).

In phase II (primary construction), *HAR-2282*, from near the base of the first cut of a segment of the outer ditch, and *HAR-4072*, from a posthole which was probably an entrance feature of the same ditch, are treated as *termini post quos* because the samples for them consisted mainly and wholly of oak respectively. The model shows poor agreement if two results on an oak sample from the initial fill of the inner ditch (P76 C5 241) are included, whether or

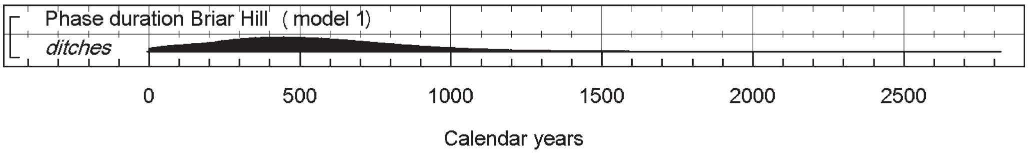


Fig. 6.22. Briar Hill. Number of years during which the enclosure was in use, derived from the model defined in Fig. 6.21.

not they are treated as a *terminus post quem* ($A_{overall}$=30.5%; 34.6%), and they are therefore excluded. These are two of the small counter measurements described above, and so may be anomalously young on scientific grounds.

In phases III and IV (first and second major recuts), *HAR-5271* is included in the model because it was measured on short-lived charcoal; of the two remaining dates, both from the small counter, HAR-4110, measured on oak, might be treated as *a terminus post quem* and HAR-5125 might be accepted. If this is done, however, the model is in poor agreement ($A_{overall}$=30.5%), essentially because both are more recent than dates on short-lived samples from phase VII. They are therefore excluded, and may also be anomalously young because of initial problems with the miniature counter at Harwell.

In phase VII (final recut), *HAR-4092*, measured on a mixture of oak and other species, is treated as a *terminus post quem*. Three measurements on short-lived samples (*HAR-3208, -4071, -4075*) are statistically consistent with each other and with a measurement on an unidentified sample (*HAR-5217*; T'=4.6; T'(5%)=7.8; ν=3), and are therefore included in the model. *HAR-3208, -4075* and *-5217* were from discrete deposits of burnt material, which may have derived from single events; the sample for *HAR-3208* may, indeed, have been pyre debris (Table 6.6). Only the sample for *HAR-4071* came from near the top of the upper fills. The samples should be little older than the final filling of the ditch.

From this model, it is possible to suggest a construction date for the enclosure of *4170–3355 cal BC* (*95% probability*; Fig. 6.21: *build Briar Hill*), probably of *3745–3415 cal BC* (*68% probability*), the final early Neolithic ditch fills being deposited in *3475–3425 cal BC* (*1% probability*; Fig. 6.21: *end Briar Hill ditches*) or *3370–2735 cal BC* (*94% probability*), probably in *3335–2995 cal BC* (*68% probability*). On this basis the enclosure would have been in use for *1–1190 years* (*95% probability*; Fig. 6.22: *ditches*), probably for *185–780 years* (*68% probability*).

All the other radiocarbon dates from Briar Hill relate to later Neolithic and Bronze Age activity on the hilltop (Fig. 6.21). The samples attributed to phase VIII were solely or partly of oak and are treated as *termini post quos*. *HAR-2625* and *-4057* indicate third millennium dates for two repeatedly recut postpits which could have held uprights almost 1 m across (Bamford 1985, 44, fig. 23). *HAR-2607* does the same for a horseshoe-plan wooden structure, the bedding trench of which was so deep as to suggest that it had stood to a considerable height, aligned with a further, linear, bedding trench and a row of postholes. Grooved Ware in the bedding trench of the structure and in two of the postholes reinforces the linkage indicated by the alignment (Bamford 1985, 44, fig. 22). Phase IX includes four dated pits, one of which contained Beaker, which cut the infilled inner ditch (*P76 E7 041*, *HAR-4067*, *-4073*, *-4089*). The latest dates come from two Bronze Age cremations (*HAR-4058*, *-4065*).

Figure 6.23 shows our alternative, preferred model for the chronology of the causewayed enclosure, with the same exclusions and *termini post quos* as that shown in Fig. 6.21. Here, the three ditches are separated and the results from the inner ditch are divided into upper and lower fills. The use of one result calls for comment. *HAR-4066*, attributed to phase VIII (later occupation) in the first model (Bamford 1985, table 27), came from a layer that extended the width of a ditch segment and was stratified below three further layers (Fig. 6.20: section A: context 248B (3)). Its assignation to a post-enclosure phase was based on its radiocarbon date and on the disparity between it and *HAR-5217*, from a context which, on the most obvious reading of the section, would post-date it (Fig. 6.23; Fig. 6.20: section A: context 248C (2)). There are various possible interpretations. The sample for *HAR-5217*, although of short-lived charcoal, may, for example, have included redeposited material; or a root- or animal-disturbance shown extending into 248B (3) on the published section may have introduced more recent material into the sample for HAR-4066. For this reason, this measurement is excluded from the model. An undetected recut seems unlikely, given a succession of three horizontally bedded layers above 248B (3).

The second model provides an estimated construction date of *4250–3355 cal BC* (95% *probability*; Fig. 6.23: *build Briar Hill*), probably of *3760–3415 cal BC* (*68%* probability). The estimate for the early Neolithic disuse of the ditches is *3485–2520 cal BC* (*95% probability*; Fig. 6.23: *end Briar Hill ditches*), probably *3340–2955 cal BC* (*68% probability*). According to this interpretation the enclosure was in use for *5–645 years* (*95% probability*; Fig. 6.24: *use Briar Hill ditches*), probably for *150–505 years* (*68% probability*).

Implications for Briar Hill

No further samples have been dated as part of this project, as no suitable charred material from low down in the ditches was identified from the archive. An assessment of the ceramics for charred residues might yield a few more samples, although this has not been undertaken because the degraded nature of the assemblage did not offer strong prospects of success.

The two models presented above produce similar chronologies. They place the construction of the enclosure within the fourth millennium cal BC, rather than in the

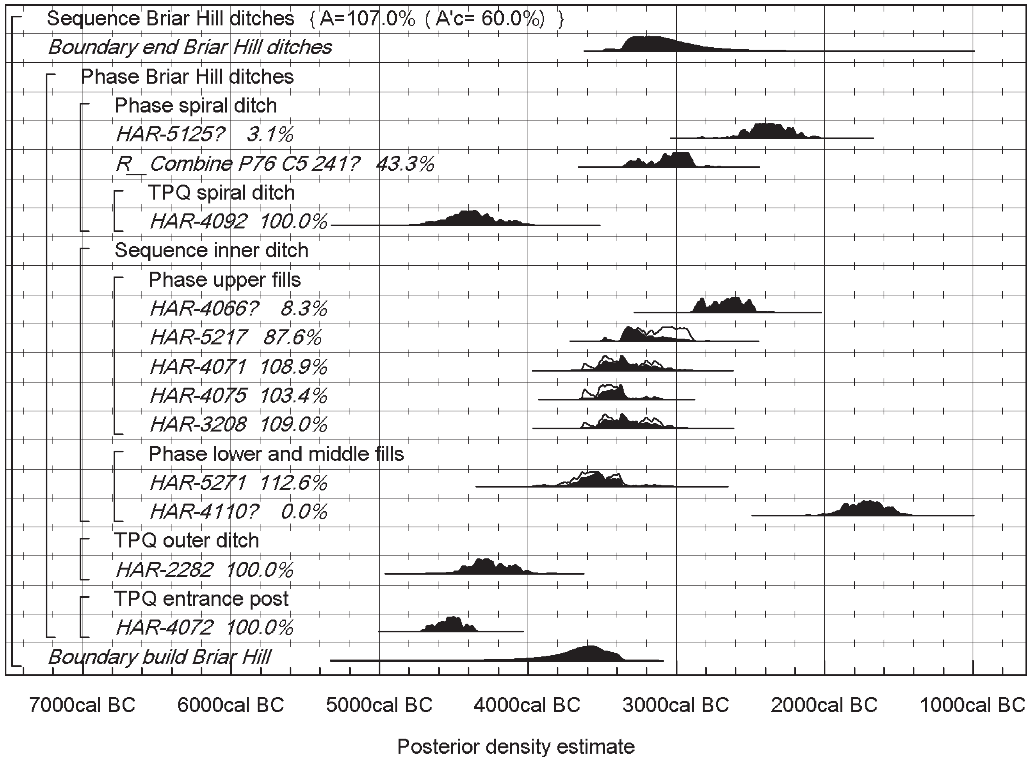


Fig. 6.23. Briar Hill. Probability distributions of dates from the ditches, separating samples from each ditch. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

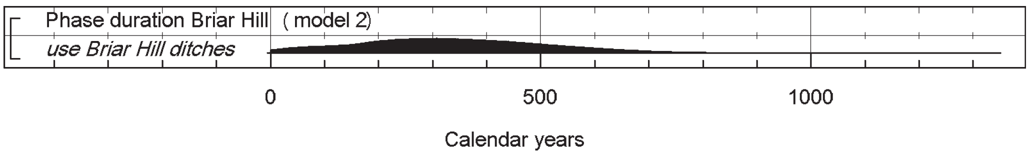


Fig. 6.24. Briar Hill. Number of years during which the enclosure was in primary use, derived from the model defined in Fig. 6.23.

later part of the fifth millennium as suggested by Bamford (1985, 40). It is most likely to have been built in the middle centuries of the millennium (Figs 6.21 and 6.23: *build Briar Hill*). The chronological sequence, or lack of it, between the three ditches remains unresolved. Mercer's suggested later Neolithic date for the spiral ditch (1990) is implausible in the light of the concentration in it of early Neolithic artefacts, which it is difficult to see as an accident of redeposition. The models also agree in placing the final infilling of the enclosure ditches (as distinct from the cutting of pits into them) in the second half of the fourth millennium or the first half of the third millennium cal BC, most plausibly in the last third of the fourth millennium (Figs 6.21 and 6.23: *end Briar Hill ditches*). It is possible that there was continuity of use of the site into the third millennium cal BC, with the timber structures of phase VIII. A possible henge inside the Dallington enclosure may reflect a similar history (Oswald *et al*. 2001, fig. 3.4). The Briar Hill enclosure was apparently in use for several centuries (Figs 6.22 and 6.24: *use Briar Hill ditches*).

Reliable evidence for the dating of the Briar Hill enclosure is limited, and reflected in imprecise chronological estimates provided by the models. The outer ditch and the spiral ditch are dated only by radiocarbon measurements which provide *termini post quos* for their contexts. A dearth of samples from the lower levels of the ditches and a continuing scarcity in the upper ones mean that this unsatisfactory state of affairs will persist.

6.3.2 Implications for the Nene valley

Downstream from Briar Hill and Dallington, the low gravel terraces of the Nene are rich in Neolithic and Early Bronze Age monuments (Last 2005; Harding and Healy 2007, table 4.1, fig. 5.13). Some of them are masked by alluvium. Two probable causewayed enclosures are, like Briar Hill, on the valley side, at Southwick, Northamptonshire, and Upton, Cambridgeshire (Fig. 6.1). These are both double circuits, close to tributaries and 'tilted' towards the river (Oswald *et al*. 2001, figs 3.2, 6.3, 8.10). Also on the valley side, in Dog Kennel Field, Elton, Cambridgeshire, was a sub-polygonal ditched enclosure with a maximum dimension of 16 m, which contained plain Bowl pottery and a blade-based flint industry, concentrated in a recut.

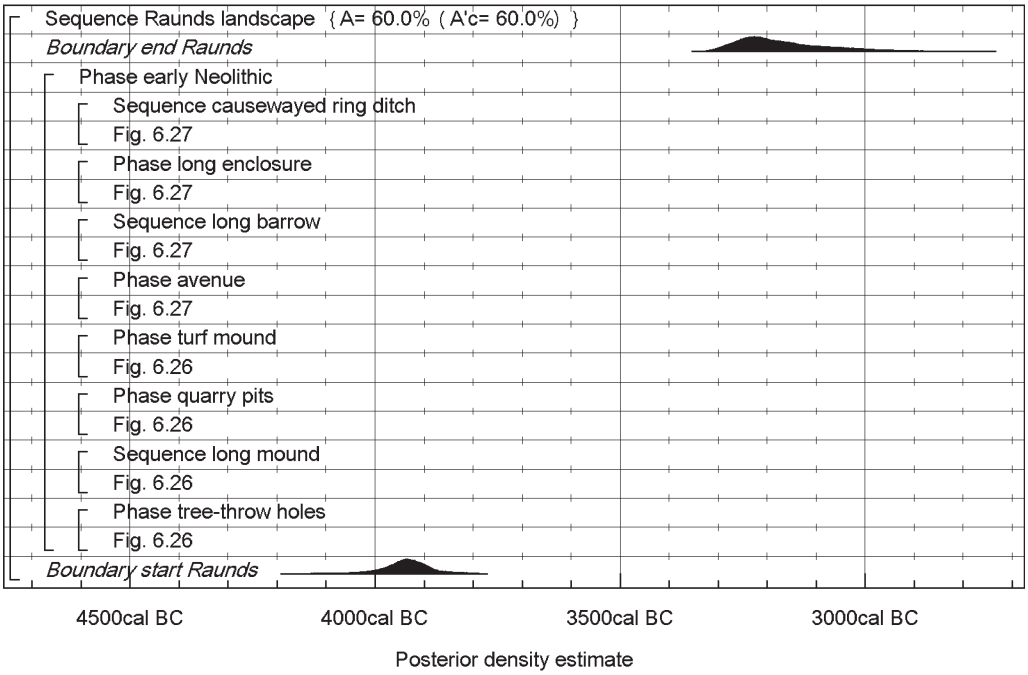


Fig. 6.25. Raunds. Overall structure of the chronological model for early to middle Neolithic activity. The component sections of this model are shown in Figs 6.26–7. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of Figs 6.25–7, along with the OxCal keywords, define the overall model exactly.

Similar material came from a pit 70 m to the west, in an area where another pit contained Peterborough Ware. An isolated pit some 2 m across containing the disarticulated and semi-articulated remains of at least four adults and one child and seven pieces of struck flint was found 65 m south of the enclosure. The rite and the struck flint both suggest a Neolithic date (French 1994, 20–4, 37–9, 46–54, 187). This site illustrates two aspects of the Neolithic archaeology of the Nene valley. Its monuments tend to be small and include forms which, like Willington Plantation or Godmanchester in the Great Ouse valley, do not correspond to familiar early Neolithic types; and many contain few or no diagnostic artefacts, so that their attribution remains conjectural in the absence of radiocarbon dates. These characteristics are even more apparent on the valley bottom, where non-classic monuments are frequent and, in contrast to the Great Ouse valley, cursus and related monuments are rare.

The diversity of valley bottom monuments is perhaps best illustrated at Raunds, Northamptonshire (Fig. 6.1). In the course of the Raunds Area Project, undertaken in the 1980s and early 1990s by the then Central Excavation Unit of English Heritage, the Northamptonshire Archaeology Unit (now Northamptonshire Archaeology) and the Oxford Archaeological Unit (now Oxford Archaeology), some 3.5 km of the floor of the Nene valley were investigated. This area included at least six Neolithic monuments, most of them previously obscured by later archaeology and by Saxon and early medieval alluvium. Monument building continued, at a fluctuating tempo, into the second millennium cal BC (Harding and Healy 2007). Dating the monuments on the valley floor was extremely difficult because many were poor in cultural material and bone preservation was generally bad. The severely restricted range of samples which could be dated successfully necessitated a reliance on charred plant remains, the taphonomy of which is often less secure than that of other sample types because of its mobility and potential heterogeneity (Ashmore 1999a). The results of the radiocarbon dating programme, reported in detail elsewhere (Bayliss *et al*. forthcoming a) are summarised here for the fifth and fourth millennia cal BC. They have been recalculated using OxCal v3.10 and the calibration curve of Reimer *et al*. (2004). The overall form of the chronological model for the early Neolithic landscape at Raunds is shown in Fig. 6.25 with its component sections given in Figs 6.26–7.

The record begins with a slight human presence in the early Holocene, which became progressively more marked. Many dead trees were burnt out, dated examples falling in the late sixth or early fifth millennium cal BC (Fig. 6.26: OxA-3059) and the late fifth or early fourth millennium (Fig. 6.26: OxA-3057), the burning in this case accompanied by the discard of a small blade-based flint industry.

One spot, at West Cotton, by the confluence of the Nene and a tributary, saw a particular concentration of Mesolithic material. A small amount of this came from a pit, and charred oak trunk fragments from its upper fill have been dated to the mid-fifth millennium cal BC (Fig. 6.26: UB-3329). Neolithic artefacts were also discarded here before the construction of a monument known as the long mound. This was about 135 m long, 18 m wide and perhaps 1.5 m high. Its scale means that its construction could have been a communal event, bringing together perhaps 50 or 100 people. Indeed, the pattern of stakeholes beneath it suggests that it was divided into hurdle-defined compartments, each of which could have been built by a different group. It was

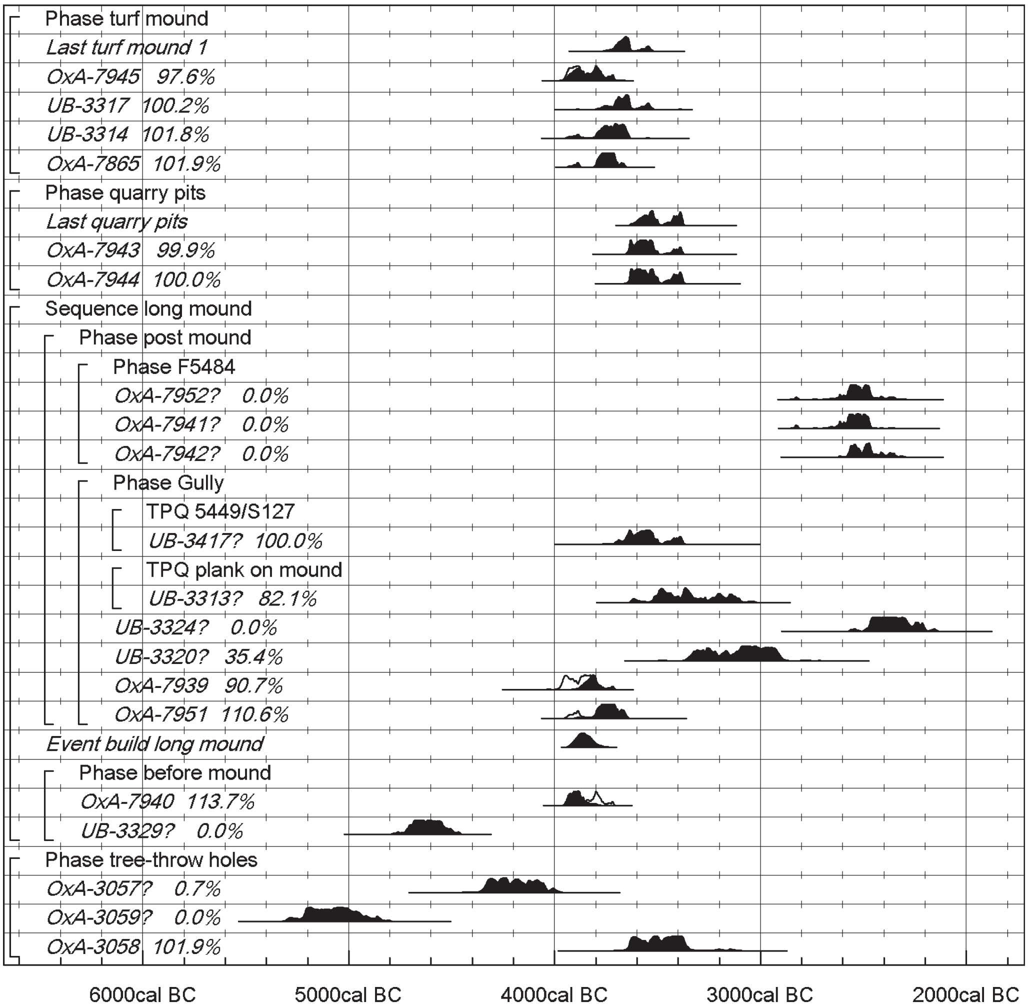


Fig. 6.26. Raunds. Probability distributions of dates from tree-throw holes, the long mound, the quarry pits and the first phase of the turf mound. The format is identical to that of Fig. 6.4. The overall structure of this model is shown in Fig. 6.25, and the other component in Fig. 6.27.

built of turf, cut from an area of something like 100 m by 100 m, which can only have been the product of grazing. In other words, livestock were being kept by the time it was built. Structural differences between the east part of the mound on the one hand and the west and centre on the other suggest that it was built in two stages, although there is no stratigraphic evidence for this.

UB-3329 provides a *terminus post quem* for the construction of the west and central parts of the Raunds long mound. A potentially much closer *terminus post quem* for the east end is provided by an early fourth millennium date (Fig. 6.26: *OxA-7940*) on a single fragment of oak sapwood incorporated in its structure. Beyond this point, the exercise becomes problematic. There are six dates on samples from contexts immediately post-dating the mound. A charred plank associated with possible refurbishment provided a measurement which calibrates to the fourth millennium (Fig. 6.26: UB-3313). The sample unfortunately consisted of oak charcoal of unknown maturity so that this measurement cannot be used as a *terminus ante quem* for the construction. Since it was a plank, it may also have come from an earlier structure. Five measurements from a gully cut into the top of the mound are not statistically consistent (T'=299.6; T'(5%)=9.5; ν=4), and their calibrated ranges cover well over a thousand years (Fig. 6.26: *OxA-7939*, *-7951*; UB-3320, -3324, -3417). One, UB-3417, was made on a bulked sample of oak charcoal of unknown maturity, which may have pre-dated the context and may have included material of varying ages. The others were all, on the face of it, likely to be of the same age as the gully fills, being made on short-lived charcoal from charred stakes set more or less vertically in the gully fills and in close proximity to each other. It is these samples, however, which provide the earliest and the latest dates from the gully.

Closer examination of the samples prompts a possible interpretation. The two measurements on single fragments of oak sapwood (Fig. 6.26: *OxA-7939, -7951*) are statistically consistent (T'=3.2; T'(5%)=3.8; ν=1), and are rather earlier than the two remaining conventional dates, which are widely scattered (Fig. 6.26: UB-3320, -3324). This suggests that these samples contained material of differing ages, which

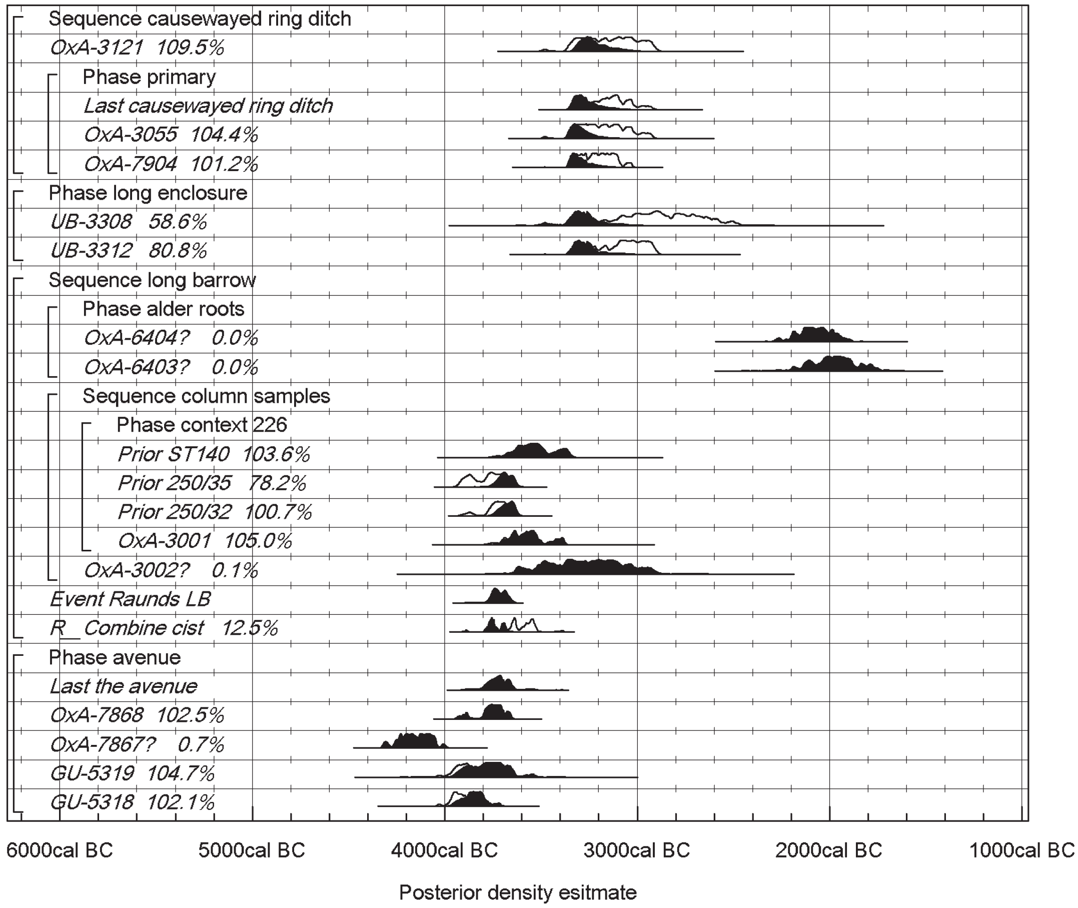


Fig. 6.27. Raunds. Probability distributions of dates from the avenue, the long barrow, the long enclosure and the causewayed ring ditch. The format is identical to that of Fig. 6.4. The overall structure of this model is shown in Fig. 6.25, and the other component in Fig. 6.26.

may have been the case, since each consisted of more than a single fragment of charcoal, although apparently from individual stakes of hazel or alder of up to 20 years' growth. That for UB-3324, although broken, seemed to consist of a single piece of wood; that for UB-3320 consisted of many fragments, less obviously from a single object. Rootlet penetration was particularly noted in the sample for UB-3324 and it may be no coincidence that this provided the latest date. The stakes stood in fills which contained much charred material and directly underlay Saxon and medieval soils, so that intrusive as well as redeposited charcoal could easily have been present, especially given the level of activity by worms, moles and rabbits in the soft, fine-grained deposits. It is pertinent that charred cereal grains of varieties likely to have derived from overlying Saxon and medieval contexts were found below and in the mound. It is thus possible that the conventional samples included some fragments derived from overlying deposits, while the AMS results on single sapwood fragments are reliable measurements on *in situ* stakes in the gully. In this case, the estimated date of construction for the long mound at Raunds, based on the three oak sapwood dates (*OxA-7939–40, -7951*), is *3930–3770 cal BC* (*95% probability;* Fig. 6.26: *build long mound*), probably *3900–3820 cal BC* (*68% probability*), and the gully may have been used for a relatively short period of time in the early fourth millennium cal BC. This is the option incorporated in the model and represented in Fig. 6.26. Hollows at least 20 m long, 7 m wide and 0.35–50 m deep flanking part of the mound bore no relation to its construction, despite being dubbed 'quarry pits', since the sandy subsoil, gravel and sandy clay which would have been extracted from them were not matched in its make-up. Two short-life samples from a burnt deposit incorporating Ebbsfleet Ware in a feature in the base of one hollow yielded statistically consistent measurements (Fig. 6.26: *OxA-7943, -7944*; T'=0.1; T'(5%)=3.8; ν=1). The date of this feature is therefore estimated at *3620–3495 cal BC* (*60% probability*; Fig. 6.26: *quarry pits*) or *3460–3370* (*35% probability*), probably at *3580–3515 cal BC* (*42% probability*) or *3425–3380 cal BC* (*26% probability*).

South of the long mound, an unditched sub-rectangular heap of turves *c.* 25 m by 23 m is known as the turf mound. This was built over a treehole in the top of which was a small lithic assemblage including two leaf-shaped arrowheads, and it was cut by two gullies in which successive fences had been burnt. The four available samples came from the second fence in one of the gullies. The sample for *UB-3314* was the tip of an oak stake which had burnt *in situ* and occupied a circular stakehole *c.* 80 mm in diameter, which strongly suggests that the stake was of fairly young wood

and thus close in age to its insertion. The consistency of all the measurements strongly suggests that the real age of the second fence in the eastern gully is likely to be close to the estimated date of *3750–3625 cal BC* (*78% probability*; Fig. 6.26: *turf mound 1*) or *3600–3525 cal BC* (*17% probability*), probably of *3705–3630 cal BC* (*68% probability*). The intervals between the construction of the mound and the cutting of the two successive pairs of gullies can only be guessed at.

South-west of this were cut two rows of irregular, approximately parallel ditches and hollows 60 m long and 7–9 m apart, known as the avenue. These features were slight, at most 0.60 m deep and often less. They contained virtually no artefacts and their fills were often characterised by varying quantities of burnt soil, charcoal, and charred plant remains, although burnt material was not ubiquitous. Oak charcoal was abundant, and the diverse charred plant remains included onion couch grass tubers, hazelnut shell and a few possibly intrusive grains of emmer or spelt wheat and indeterminate cereal. Some of this material had been burnt *in situ.* Two single pieces of charred oak from parts of the same feature yielded statistically consistent results in the early fourth millennium cal BC (Fig. 6.27: *GU-5318–9*; T'=0.6; T'(5%)=3.8; ν=1). A third consistent measurement was provided by a charred hazelnut shell from another length of ditch (Fig. 6.27: *OxA-7868*; T'=2.6; T'(5%)=6.0; ν=2). These three measurements provide an estimated date for this feature of *3850–3625 cal BC* (*92% probability;* Fig. 6.27: *the avenue*) or *3585–3525 cal BC* (*3% probability*), probably *3770–3655 cal BC* (*68% probability*). If the monument was indeed short-lived, this may have been close to the time of its construction. Three fifth millennium measurements on charred onion couch grass tubers from the avenue and from a later monument which cut it (Table 6.7: OxA-7867, OxA-7907, -7958) are not statistically consistent (T'=4.1; T'(5%)=8.6; ν=2), but reflect human activity, as well as the presence of little-grazed grassland. They may either relate to vegetation burning prior to the construction of the monument or indicate a fifth millennium origin for the avenue itself, the fourth millennium material relating to its latest use or destruction.

None of these three non-classic monuments was initially funerary, although an infant cremation was later placed in one of the 'quarry pits' of the long mound. The only long barrow in the Raunds complex, to the south-west of the avenue, stands out by conforming to a well known monument type and by incorporating human remains, although only a minimal amount. It was, like the other monuments, built on a site that had already seen some activity, evidenced by early Neolithic lithics.

The Raunds long barrow initially took the form of a massive timber façade, beyond which was a rectangular limestone cist containing small, weathered fragments of a single longbone, as well as a dubiously primary pit covered by more limestone. A trapezoid mound approximately 50 m long was raised from two flanking ditches, with a timber revetment, the bedding trench for which cut and replaced the façade. The ditch bases were waterlogged, preserving plants, insects and pollen which indicated that the barrow had been built in a lightly grazed clearing in recent cleared woodland. Opium poppy seeds from these fills expand the range of ultimately Near Eastern plant species introduced to Britain in the fourth millennium cal BC. Also in the ditch were clusters of woodchips and offcuts from the construction of the revetment. The flint axehead used to do the job had been left at the barrow, its battered and damaged cutting edge precisely fitting some of the cutmarks on the wood. By the time a little over half a metre of silts had accumulated in the waterlogged bottoms of the ditches, the clearing and probably the mound itself were recolonised by scrubby woodland, on the evidence of the pollen, plant macrofossils and insects from the top of the waterlogged fills. Above the limit of waterlogging, the ditches silted gradually and naturally, and Peterborough Ware was placed preferentially in one ditch butt, and lithics and animal bone in the other.

The façade of the long barrow remains undated. Since it preceded the mound revetment and would have stood for an unknown period before the mound was built, the construction date estimated here is a minimum one. Two dates on one of the fragments of possibly human bone from the cist (OxA-5632–3) are statistically consistent (Table 6.7). The cist probably pre-dated the mound because it was built on the old land surface, although so little of the mound survived at this point that certainty is impossible. Waterlogged fills immediately above the primary silts of the ditches are bracketed by measurements on seeds from the lowest and topmost layers (Fig. 6.27: *OxA-3001*, -3002). A plank and woodchips, almost certainly generated during the construction of the wooden revetment of the mound (Fig. 6.27: *ST140, 850/35, 250/32*), were preserved in the same layer as the sample for *OxA-3001*. The dated woodchip samples were of sapwood, but none retained bark. The probability distributions of the dates of the woodchips have been shifted by an estimate of the number of sapwood rings which were missing from the dated samples (see Bayliss and Tyers 2004). This has the effect of making the calibrated dates slightly younger than they would otherwise be. This model estimates that the construction of the long barrow at Raunds occurred in *3795–3635 cal BC* (*95% probability*; Fig. 6.27: *Raunds LB*), probably in *3760–3710 cal BC* (*44% probability*) or *3705–3675 cal BC* (*24% probability*).

Although some traces of activity preceded all four monuments, there is little sign that people lived in the valley bottom at Raunds once they were built. It seems rather that they were nearby, possibly on the valley sides. The alignment of monuments was filled out in the course of the fourth millennium. An elongated ditched enclosure, the long enclosure, probably over 100 m long and aligned on the turf mound, yielded few finds. Two samples, however, an antler 'rake' and a cattle tibia fragment, were dated from the primary silts. These provided statistically consistent measurements (Table 6.7: *UB-3312*, *-3308*; T'=0.6; T'(5%)=3.8; ν=1). It seems probable that the antler was used to build the enclosure, in which case it is likely to be close in age to

Table 6.7. Radiocarbon dates from the Nene valley. Posterior density estimates derive from the models defined in Figs 6.25–7 and 6.28.

Laboratory Number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Raunds treeholes, Northamptonshire								
OxA-3058	291-33044	*Corylus/Alnus* charcoal	62114. Top fill of treehole F62113 in trench B140	4700±80	-25.7		3650–3340	*3645–3345*
OxA-3059	291-33037	Charcoal of short-lived species, i.e. not oak etc	62127. Upper fill of treehole F62126 in trench B140	6130±80	−26.6		5310–4840	
OxA-3057	291-33047	Charcoal of short-lived species	62140. Bottom fill of treehole F62123 in trench B140. Treehole contained an assemblage of 97 pieces of struck flint including refitting flakes and blades and small chips, both indicative of little displacement. Also present were a backed blade, a piercer, a denticulate, two further scrapers, a possible burin and a possible microburin	5370±80	−26.6		4360–3980	
Raunds long mound, Northamptonshire								
UB-3329	WC85-S139	*Quercus* sp. charcoal from trunk fragments	5460. Fire lit in hollow in top of pit F5488 beneath W end of long mound. Lower fill contained a flake, a blade and a microlith tip	5767±58	−24.8±0.2		4770–4460	
OxA-7940	S27/2061	*Quercus* sp. sapwood charcoal	2061. Mound	5035±30	−24.7		3960–3710	*3950–3825* (*93%*) or *3815–3795* (*2%*)
UB-3313	WC85-S28	*Quercus* sp. Charcoal	2062. 'Plank' on surface of mound at east end	4602±72	−26.1±0.2		3630–3090	
UB-3417	WC85-S127	*Quercus* sp. charcoal fragments	5449. West end of gully cut into top of mound	4795±71	−24.6±0.2		3710–3370	
OxA-7939	S25/990	*Quercus* sp. sapwood charcoal	990. Charred stake in gully F938 cut into top of mound	5090±45	−24.9		3900–3710	*3885–3755* (*88%*) or *3745–3710* (*7%*)
OxA-7951	S26/990	*Quercus* sp. sapwood charcoal	990. Stake in gully F938 cut into top of mound	4970±50	−24.4		3900–3640	*3820–3645*
UB-3324	WC85-S20	*Corylus/Alnus* charcoal	990. Stake within east end of gully F938 cut into top of mound. 20 years growth, rootlet penetration	3883±58	−26.1±0.2		2570–2150	
UB-3320	WC85-S24	*Corylus/Alnus* charcoal, 10–20 years growth	990. Stake in east end of gully F938 cut into top of mound	4417±75	−27.2±0.2		3360–2890	

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-7944	WC85-850/5261	Charred *Arrhenatherum elatius* ssp. *bulbosum* tuber	5261. Fill of 'quarry pit' F5263 alongside monument	4750±45	−26.1		3640–3370	*3640–3495* (*73%*) or *3455–3375* (*22%*)
OxA-7943	WC85-874/5261	*Corylus* sp. nut shell fragments	From the same context as OxA-7944	4770±45	−23.9		3650–3370	*3650–3495* (*82%*) or *3435–3375* (*13%*)
OxA-7942	S133/5456	*Quercus* sp. sapwood charcoal	5456. Group of charred wood fragments apparently burnt *in situ* in top of F5484 in disturbed area beneath W end of mound	3970±45	−24.2		2580–2340	
OxA-7941	S136/5456	*Quercus* sp. sapwood charcoal	From the same context as OxA-7942	4015±45	−23.7		2840–2360	
OxA-7952	S134/5457	*Quercus* sp. sapwood charcoal	5457. Group of charred wood fragments apparently burnt *in situ* in top of F5484 in disturbed area beneath W end of mound	3995±50	−24.8		2830–2340	
Raunds avenue, Northamptonshire								
OxA-7868	291-99156	Charred hazel nut shell	87502. Fill of F87501 of avenue	4970±45	−24.4		3940–3650	*3930–3870* (*9%*) or *3810–3645* (*86%*)
OxA-7867	291-99158	Charred tubers	87507. Fill of F87506 of avenue	5325±50	−27.2		4330–3990	
GU-5319	291-99251	*Quercus* sp. charcoal, recorded in field as single piece, *c.* 100 mm × 60 mm	87569. Fill of F87566 of avenue, a section of the same feature as F87647	4990±110	−24.6		4040–3530	*3955–3630* (*93%*) or *3565–3530* (*2%*)
GU-5318	291-99228	*Quercus* sp. charcoal, recorded in field as single piece *c.* 70 mm × 60 mm	87648. Fill of F87647 of avenue, a section of the same feature as F87566	5090±60	−23.7		4040–3710	*3960–3755* (*91%*) or *3745–3710* (*4%*)
Raunds segmented ditch circle, Northamptonshire								
OxA-7907	291-99196	Charred *Arrhenatherum elatius* ssp. *bulbosum* tuber	87556. Main fill of pit F87555 of segmented ditch circle, cutting avenue	5750±45	−24.6		4720–4460	
OxA-7958	291-99191	Charred *Arrhenatherum elatius* ssp. *bulbosum* tuber	87560. Main fill of pit F87559 of segmented ditch circle, cutting avenue	5455±70	−27.8		4450–4070	

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-7906	291-99206	Charred *Corylus* sp. nut shell fragment	87595. One of two fragments from cremation pit F87594 within avenue and segmented ditch circle	8715±60	−23.1		7960–7590	
Raunds long barrow, Northamptonshire								
OxA-5632	233	Weathered human long bone. Replicate of OxA-5633	233(1). Fill of cist 233	4825±65	−20.2	4823±50 T'=0.0, T'(5%)=3.8, ν=1)	3710–3510	*3895–3660*
OxA-5633	233	Weathered human long bone. Replicate of OxA-5632	From the same context as OxA-5632	4820±80	−20.5			
OxA-5551	ST 239	?Red deer. Humerus	239(1). Fill of pit 239	2655±55	−21.6		920–770	
OxA-3001	ST128	Waterlogged seeds, 12 species identified, submerged aquatics excluded	226. Top of waterlogged fill of southern barrow ditch	4810±80	−26.0 (assumed)		3760–3370	*3705–3495* (*79%*) or *3465–3375* (*16%*)
OxA-3002	ST131	Waterlogged seeds, 13 species identified, submerged aquatics excluded	229. Base of waterlogged fill of southern barrow ditch	4560±140	−26.0 (assumed)		3650–2890	
OxA-6406	250, 32	Waterlogged *Quercus* sp. sapwood chip	226. Dump of wood working debris within context 226, near bottom of southern barrow ditch, F303; toolmarks match worn edge of flint axehead from same ditch	4960±45	−27.4		3930–3640	*3745–3615*[1]
OxA-6405	250, 35	Waterlogged *Quercus* sp. sapwood chip	From the same context as OxA-6406	5005±50	−26.5		3960–3650	*3755–3620*[1]
OxA-3003	ST140	Waterlogged outer rings of *Quercus* sp. plank. Remainder identified as sapwood	226. Near bottom of southern barrow ditch	4790±90	−26.0 (assumed)		3760–3360	*3680–3345*[1]

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-6403	168, 276	Waterlogged *Alnus glutinosa* root cluster	168. Growing into fills of southern barrow ditch	3610±80	−27.0		2200–1740	
OxA-6404	185, 284	Waterlogged *Alnus glutinosa* root cluster	168. Growing into fills of southern barrow ditch	3685±65	−28.4		2290–1890	
Raunds turf mound, Northamptonshire								
UB-3317	WC85-S98	*Quercus* sp. charcoal fragments	6302. Fill of gully F6303 cut into top of N end of mound, close to stake dated by UB-3314 and possibly derived from it	4873±56	−24.8±0.2		3780–3530	*3785–3625* (*79%*) or *3600–3525* (*16%*)
UB-3314	WC85-S99	Charred *Quercus* sp. stake *c.* 80 mm diameter	From the same context as UB-3317	4937±56	−24.1±0.2		3930–3630	*3920–3870* (*5%*) or *3810–3635* (*90%*)
OxA-7945	S97/6302	Charred *Corylus* root	From the same context as UB-3317	5035±35	−23.9		3960–3700	*3940–3755* (*88%*) or *3745–3710* (*7%*)
OxA-7865	S100/6361	Charred *Corylus* root	6361. Fill of gully F6366 cut into top of N end of mound	4975±35	−24.3		3910–3650	*3910–3875* (*5%*) or *3805–3655* (*90%*)
Raunds long enclosure, Northamptonshire								
UB-3308	WC85-S32	Proximal cattle tibia	2102. Primary fill of enclosure ditch, *c.* 0.15 m above base	4278±156	−28.4±0.2		3370–2470	*3520–3405* (*7%*) or *3385–3040* (*88%*)
UB-3312	WC85-S56	Red deer antler 'rake'	2102. Primary fill of enclosure ditch, *c.* 0.10 m above base	4411±77	−23.5±0.2		3360–2880	*3365–3065*
Raunds causewayed ring-ditch, Northamptonshire								
OxA-3055	291-33421	*Alnus/Corylus* charcoal	38317. Primary silt of N terminal	4480±70	−23.4		3370–2910	*3495–3465* (*3%*) or *3375–3135* (*92%*)
OxA-7904	291-55374	*Corylus* sp charcoal	38387. Primary silt	4505±45	−23.8		3370–3020	*3370–3150*
OxA-3121	291-55372	Red deer antler tine	38100. Part of fragmentary antler implement lying beside antler pick in recut in S terminal of ditch	4450±90	−23.0		3490–2890	*3335–3050*
Grendon, area C, ring ditch V, Northamptonshire								
HAR-1498	AREACF63	*Quercus* charcoal	F63. One of at least 3 postholes in central area of monument, 1 containing the dated charcoal and 1 containing 2 sherds in fabric similar to that of Neolithic Bowl pottery from site. Postpipe approx. 40 m across (Gibson and McCormick 1985, 35–8, 46–64, mf 7–9, 13, 25–32, 37–8; Jordan *et al.* 1994, 66)	4950±80	−26.5		3960–3630	

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
HAR-1497	AREACF35	Blackthorn twig and mature *Quercus* charcoal	F35. Top of silts of U-plan ditch surrounding mound covering context of HAR-1498.Finds from ditch fills as a whole (neither layers nor depths specified) include human occipital fragment, various cattle bones (some butchered), smaller quantities of pig and caprine bones, including fragments of a goat skull with horns, 20 sherds Neolithic Bowl (including P22, P25, P35, P38 in original report), 3 joining base fragments plain Beaker or small urn (P51 in original report), small amount of struck flint from blade-based industry (Gibson and McCormick 1985, 35–8, 46–64, mf 7–9, 13, 25–32, 37–8; Jordan *et al.* 1994, 66)	4700±130	−24.9		3710–3090	
HAR-1495	AREACF37	*Quercus* charcoal	F37 (15W). Postpipe 15 in bedding trench of post-built façade with central entrance built across open end of 'U'-plan ditch and eventually burnt. Postpipe approx. 0.30 m across. Finds from façade trench include small quantities of cattle, caprine and pig bone, 13 sherds Neolithic Bowl (including P8, P13, P14 and P46 in original report), and something of a concentration of struck flint. (Gibson and McCormick 1985, 35–8, 46–64, mf 7–9, 13, 25–32, 37–8; Jordan *et al.* 1994, 66)	4280±70	−24.9		3090–2670	
Aldwincle, site 1 , Northamptonshire								
HAR-1411	B18AEAST	*Quercus* charcoal at least 100 mm in diameter ('three bags combined'). Remainder identified as *Quercus* sp. probably all heartwood	Charcoal layer, derived from interior, *c.* 0.30 m from base of short, straight length of ditch across open end of irregular horseshoe-plan ditch which truncated first enclosure around multi-phase funerary area (D. Jackson 1976, 13–30, 56; Jordan *et al.* 1994, 3–4)	4560±70	−27.2		3520–3020	
Tansor Crossroads, Northamptonshire								
Beta-84660		*Quercus* heartwood (?from mature timbers) and *Corylus* charcoal	F167. Beneath Mortlake Ware sherds in feature tentatively identified as posthole of mortuary structure in multi-phase funerary monument (Chapman 1997, 21–4, figs 7–8)	4720±90			3660–3340	

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Beta-84659		*Quercus* heartwood charcoal	F152. Scattered through fill of pit containing probable Beaker sherd and underlying mound (Chapman 1997, 24, figs 7–8)	3610±90			2210–1730	
Orton Meadows, OLB2, Peterborough								
UB-3246	OLB2F58, sf 654	Human. Articulated skeleton of male	F58, burial 6. Crouched on stone paving in rectangular depression in base of grave cut through possible façade trench of pre-existing burial zone (Mackreth forthcoming)	4741±43	−20.7±0.2		3640–3370	
UB-3248	OLB2F35, sf 563	Human. Articulated skeleton of male	F35, burial 11. One, probably the latest, of 8 individuals in varying degrees of articulation placed on paving of second burial alignment, bracketed by 2 large axial postholes *c.* 3.5 m apart, in silted ditch of oval mound covering first alignment. Alignment included two inverted Bowls, with internally fluted rims in contrast to the two plain 'Grimston Ware' Bowls accompanying the first alignment (Mackreth forthcoming)	4713±84	−22.2±0.2		3660–3340	
Padholme Road, Fengate, Peterborough								
GaK-4197[2]		*Quercus* sp roundwood charcoal, probably <100 years old	F59. Corner posthole of quadrangular area *c.* 7 m x 8.5 m defined by discontinuous, irregular, linear features containing Neolithic Bowl pottery, blade-based flint industry including single-piece sickle, flake from Group VI axehead, limestone pounder, jet bead. Originally interpreted as bedding trenches of house, later seen as ceremonial (Pryor 1974, 6–38, figs 4–13; Pryor 1988; Pryor 2001, table 16.1))	4527±50			3490–3020	
GaK-4196[2]		Unidentified charcoal	F39c. Lateral gully of same structure as context of GaK-4197, close to F59	5108±64			3960–3660	
Storey's Bar Road, Fengate, Peterborough								
HAR-770		Twig and small roundwood charcoal	P10. Pit containing charcoal concentration, a few burnt animal bones and large late Neolithic flint industry in god condition, some way removed from main concentration of Grooved Ware features. Date slightly earlier than expected by excavator (Pryor 1978, 58, 226, figs 5, 36, table 40). 'Sample size below that normally required for optimum statistics' (lab.)	4460±130			2200–1740	
Parnwell, Peterborough								
NZA-24076		Charred hazelnut shell	Context 2418. Second fill of nine in pit 2289	4728±30	−24.3		3640–3370	*3625–3550* (*24%*) or *3540–3495* (*26%*) or *3455–3375* (*45%*)

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
NZA-24077		Charred hazelnut shell	Context 2311. Sixth fill of nine in pit 2289	4736±35	−24.1		3640–3370	*3640–3495* (*85%*) or *3435–3385* (*10%*)
Elton henge, Cambridgeshire								
HAR-3111	ELTON1(5)	*Quercus* sp. charcoal from mature timbers	Dark layer almost at bottom of ditch of enclosure *c*. 100 m in diameter, with evidence for external bank and slight berm. Ditch 5.5 m wide, <1 m deep (Pryor 1985c, 302; A. Harding 1987, 81–3); Jordan *et al*. 1994, 54). Laboratory notes that small size of sample accounts for larger than normal error term	4050±110	−27.0		3950–3700	

[1] *250/32, 230/35, ST140*; the calibrated date has been shifted by the probability distribution of the number of sapwood rings in English oak (Bayliss and Tyers 2004).
[2] Gak-4196 and -4197 were originally published calculated using the 'Libby' half-life of 5570 years (Pryor 1974, 38). They have been converted here to the 5568 year half-life.

its construction. For this reason and because of the large error on *UB-3308*, which was a very small sample, *UB-3312* is preferred as a more robust estimate for the date of construction. This is *3365–3065 cal BC* (*95% probability*; Fig. 6.27: *UB-3312*), probably *3345–3230 cal BC* (*68% probability*).

Between the turf mound and the avenue, a causewayed ring ditch enclosed an area 23 m by 21 m and was interrupted to the west by a 3 m-wide causeway flanked by rounded terminals. The very narrow base of the ditch may originally have held timbers. Two short-lived, single-entity samples came from the primary silts just above the ditch base, in the form of charred fragments of hazel or alder roundwood (Fig. 6.27: *OxA-3055, -7904*). The two measurements are statistically consistent with each other (T'=0.1; T'(5%)=3.8; ν=1) and with a third for an antler implement on the base of a recut which it may plausibly have been used to dig (Fig. 6.27: OxA-3121; T'=0.3; T'(5%)=3.8; ν=1). The short interval which this indicates between construction and recut is consistent with evidence for backfilling of the original ditch. The construction date of the ring ditch is estimated at *3360–3135 cal BC* (*95% probability*; Fig. 6.27: *causewayed ring ditch*), probably *3340–3235 cal BC* (*68% probability*).

A third, undated, monument may be broadly contemporary on morphological grounds. Some 200 m south of the avenue was the southern enclosure, a parallel-sided enclosure with rounded ends, 15 m wide and of unknown length, with an entrance in the centre of its surviving end. It yielded virtually no finds but had undergone multiple recuts once fully silted. Its resemblance to the long enclosure and to cursus and related monuments in general suggests a fourth millennium cal BC date.

The remainder of the dating results from Raunds are not modelled here. In summary, the woodland regeneration evidenced at the long barrow and the causewayed ring ditch corresponded to a lull in the use of this part of the valley, during which the only structure definitely dated to the early third millennium cal BC is a timber platform at the edge of a channel of the Nene. An upper layer of this contained cattle bones and a couple of human long bones which were either washed in by the river or deliberately deposited. The focus of ceremonial activity may have shifted to the Cotton 'henge', which survives as two irregular concentric ditches, the outer some 70 m in diameter, on the occupied valley side. A now destroyed circular cropmark of similar size on the valley floor within the Raunds complex may also fall in this period. By the late third millennium cal BC, however, the valley here was more heavily grazed and less wooded than ever before and monument building accelerated, with the development of a substantial round barrow cemetery.

The Raunds turf mound highlights the presence in the Nene valley of several sub-quadrangular to round mounds of fourth millennium cal BC date. Their form and the fact that, as at Raunds, they tend to occur at locations which subsequently became Early Bronze Age barrow cemeteries, make it almost certain that more remain to be identified among the numerous round barrows and ring ditches which

line the valley (Harding and Healy 2007, fig. 5.15). The same holds true of later fourth or early third millennium cal BC circular monuments like the causewayed ring ditch at Raunds. Excavated Neolithic round mounds in Northamptonshire comprise ring ditch V in area C at Grendon, upstream of Raunds, and possibly also ring ditch III in area B, which was cut by an Early Bronze Age barrow (Gibson and McCormick 1985); site 1 and possibly sites 3 and 4 at Aldwincle, downstream from Raunds (D. Jackson 1976); and one of a pair of barrows at Tansor Crossroads, north of Oundle (A. Chapman 1997). Further downstream there is mound OLB2, one of a pair of barrows in Orton Meadows on the western outskirts of Peterborough (Mackreth forthcoming). Each had a different history and, despite the confusion of salvage excavations at Grendon and Aldwincle, it is clear that each went through several stages of use, some of it funerary, and of modification, sometimes including structures and practices echoing those found in long barrows, before being covered by a mound. In some cases the mounds may not, as at Tansor Crossroads, have been raised until the establishment of the Early Bronze Age barrow cemeteries. It is thus possible that some comparable monuments were never mounded. A case in point is a small double-ditched trapezoid enclosure surrounding an unaccompanied inhumation in the Grendon complex, which in many ways is similar to the Willington Plantation burial in the Great Ouse valley. Although the central inhumation failed to yield a radiocarbon date, the silted outer ditch was cut by an Early Bronze Age inhumation and its edge was clipped by a pit containing a cattle bone identified as aurochs and hence unlikely to post-date the second millennium cal BC (Last 2005, 336–46).

At Grendon ring ditch V (Fig. 6.1; Gibson and McCormick 1985), three measurements were made, two on oak charcoal probably from single posts and one on a bulk charcoal sample partly of oak (Fig. 6.28: HAR-1498, -1497, -1495; Table 6.7). They came from three features in the central area of the monument which were interpreted as belonging to successive phases on the evidence of the dates (Gibson and McCormick 1985, 60–4). Since all three dates are *termini post quos* for their contexts, however, this is not necessarily the case, especially as the U-plan ditch and the façade which were the contexts of HAR-1497 and -1495 form a coherent plan, a problem recognised in the original report (Gibson and McCormick 1985, 60–1). HAR-1495 is surprisingly late for its context, since the sample came from a post burnt *in situ* in the bedding trench of a façade like those found in long barrows (Gibson and McCormick 1985, fig. 10). It is also late for the associated assemblage of Neolithic Bowl pottery (Gibson and McCormick 1985, fig. 19: P8, P13, P14; fig. 20: P46), which includes vessels of Mildenhall affinities, although this could have been redeposited from earlier contexts such as the U-plan ditch, F35.

At Aldwincle (Fig. 6.1; D. Jackson 1976), a *terminus post quem* for the second phase of enclosure around funerary structures is provided by a single date on bulk oak charcoal (Fig. 6.28: HAR-1411; Table 6.7). A further monument of this broad class may be present south-east of Peterborough, at Must Farm in the west of Whittlesey Island, where evaluation in advance of quarrying has revealed an upstanding ovoid barrow measuring 30 by 38 m, with Peterborough Ware in the upper ditch fill (Cambridgeshire County Council n.d.).

The monument at Tansor Crossroads (Fig. 6.1; A. Chapman 1997) may possibly, but not certainly, have had a later origin. This hinges on the interpretation of a pit and its contents. If a pit which was covered by clay before the monument was modified had held the post of a dismantled mortuary structure (A. Chapman 1997, 11), then the date of a bulk sample of oak heartwood and hazel charcoal from its lower fill (Fig. 6.28: Beta-84660; Table 6.7) may provide a *terminus post quem* for construction. This deposit could also, however, have included material introduced when the structure was dismantled. The status of sherds of a Mortlake Ware vessel on the surface of the layer containing the sample is similarly uncertain. A minimal interpretation is adopted in Fig. 6.28, the pit and its contents being taken as primary to the monument and the date as providing a *terminus post quem* for construction. A *terminus post quem* for the mounding over of the monument is provided by a date for oak heartwood charcoal from a pit containing a Beaker sherd (Fig. 6.28: Beta-84659; Table 6.7).

At Orton Meadows (Fig. 6.1; Evans and Hodder 2006, fig. 3.74; Mackreth forthcoming), the first phase of activity was a linear zone some 7 m by 1.50 m. This was flanked by a fence and a limestone setting within which were the remains of five individuals, one of them fairly fully articulated, as well as three inverted, light-rimmed, open, carinated Bowls, two of them complete. A sample from a juvenile failed to date because it contained insufficient collagen, as did a sample from an Early Bronze Age burial in the adjacent barrow (English Heritage files). The south-west end of the linear zone was marked by a limestone upright, and the north-east end by what may have been a timber façade. A small oval barrow, 10.50 m by 6 m, was raised over most of the zone and, when its ditches had silted, a second linear zone, delimited by two uprights and paved with limestone, was established in the top of the south-east one. The remains of eight individuals in varying degrees of articulation were placed in it together with two further inverted Bowls, one of them complete, this time with heavier rims and with fluting on the rim tops and the interior of the necks. One of the skeletons was dated (Fig. 6.28: UB-3248; Table 6.10). A grave was dug just beyond the north-east end of the oval barrow, cutting a possible façade trench, and an articulated burial was placed in it. This skeleton was also dated (Fig. 6.28: UB-3246; Table 6.10). Both this and the skeleton dated by UB-3248 must post-date the first linear zone, and thus provide *termini ante quos* for the initiation of the monument, putting that firmly in the earlier fourth millennium cal BC. The construction of the oval barrow and the silting and recutting of its ditches between the establishment of the first and second linear zone indicate some interval of time. This need not, however, have been long, since a ditch at most 2.50 m wide and 1 m deep cut in sands and gravels would

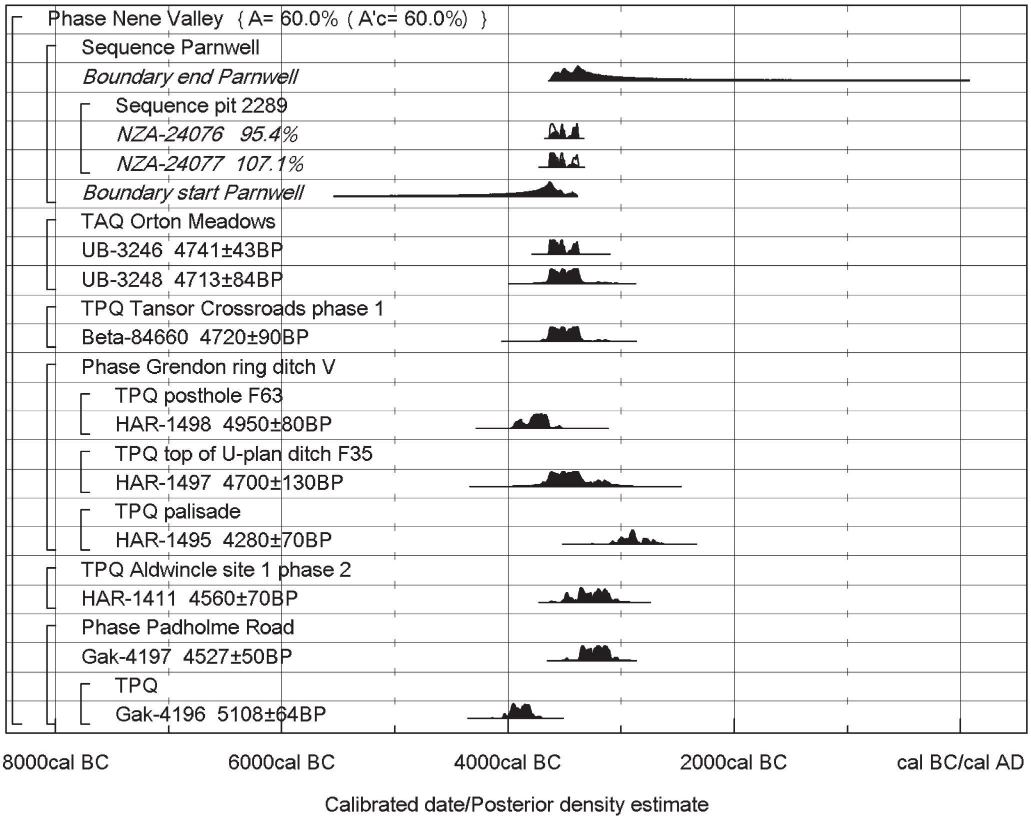


Fig. 6.28. Other sites in the Nene valley. Probability distributions of dates. Those shown in normal type have been calibrated (Stuiver and Reimer 1993); those shown in italics are modelled. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

have silted quickly. The second alignment was covered by a spread of limestone with a cairn at the north-east end. The whole monument may have been sealed beneath a ditched, sub-circular earthen mound at this stage or, as the excavator sees it, much later, when Early Bronze Age burials were inserted. Further early Neolithic activity is evidenced by plain Bowl sherds and contemporary lithics in the mound of a nearby Early Bronze Age round barrow.

At Fengate, where the Nene enters the fenland basin (Fig. 6.1), five diverse and widely spaced Neolithic or probably Neolithic structures share a north-west to south-east alignment over a kilometre long. Running at right-angles to the then fen edge, these could possibly mark a linear stretch of cleared landscape related to the driving of cattle between higher ground and the developing fen (Pryor 2001, 406–7, figs 2.10, 18.1). Four of these structures have the low levels of finds common to many monuments in the valley. Two slight parallel ditches more than 60 m long and 2 m apart, converging at their north-west end (Pryor 1984, 7–10), are dated primarily by their alignment with the others, although one contained a flake from a group VI axehead (Pryor 1974, 14). A sharply rectilinear elongated enclosure measuring 50 m by 30 m yielded a small blade-based flint industry and was cut when silted by a feature containing Beaker pottery (Pryor 1993). A trench-like grave, measuring 4 m by 2 m, contained the remains of two adults, a child and an infant in varying states of articulation and all buried at the same time. There was a leaf-shaped arrowhead, apparently the cause of death, beneath the sternum of an adult male, the only fully articulated skeleton in the group (Pryor 1984, 19–27). There was plain Bowl pottery in one posthole of the first phase of a quadrangular structure measuring 8 m by 5 m, while postholes of a separate and probably later row to one side of it contained Peterborough Ware (Pryor 2001, 47–50).

The only substantial artefact assemblage and the only radiocarbon dates come from a quadrangular structure *c.* 8.5 m by 7 m on the Padholme Road subsite, formed of discontinuous, irregular gullies (Pryor 1974, 6–8). This was originally seen as a house and later as a possible mortuary structure. The artefact assemblage stands out not only by its existence but by its rare and exotic items. The 275 lithics include a large, finely worked, bifacially flaked, single-piece sickle of non-local flint and a blade struck from a group VI axehead; there is also a jet bead (Pryor 1974, fig. 8). The 686 g of pottery were of local manufacture, including sherds of several open, flaring-necked Bowls, some with rounded shoulders, with light rims and sometimes thickened necks, undecorated apart from fluting on the interior of one rim (Pryor 1974, fig. 6).

Two radiocarbon measurements for the Padholme Road structure (Fig. 6.28: Gak-4196–7) are statistically inconsistent (Table 6.7: T'=51.97; T'(5%)=3.8; ν=1). The older of the two (Gak-4196) was measured on dispersed charcoal so that the sample may have included material of diverse ages, and it is treated as a *terminus post quem* for

the structure. The more recent (Gak-4197) was measured on oak roundwood charcoal found with its grain running vertically (Pryor 1974, 8) in a posthole in a corner of the structure. This was almost certainly the remains of a post and, as roundwood, may be only slightly older than its context (Pryor 2001, 407). A date in the second half of the fourth millennium cal BC, however, would be exceptionally late for the pottery assemblage and for a flint industry with an emphasis on blade production. Whatever the role of the structure, its scale and plan have points in common with some of the funerary monuments higher up the valley, as do those of the post-built structure to the south-east.

North of the Fengate alignment, a slight penannular ring ditch some 14 m across, which had probably never surrounded a mound, may have been a further Neolithic monument on the perhaps tenuous grounds that the only finds from it were three flint artefacts in fresh condition and of Neolithic technology (Pryor 2001, 45–7, 250, 318–19). Like the causewayed ring ditch at Raunds, it is one of a handful of certain or possible henge-like monuments along the valley. There may also be a third large henge monument in addition to the two possible examples at Raunds, in the form of a 100 m diameter cropmark on the valley side at Elton (A. Harding 1987, 81–3), more than 3 km away from the early Neolithic features in Dog Kennel Field. There is a third millennium cal BC *terminus post quem* for this in the form of a radiocarbon date on bulk oak charcoal from near the ditch base (Table 6.7: HAR-3111).

The Fengate 'mortuary' enclosure is one of only a few linear enclosures in the valley, including the long enclosure and southern enclosure at Raunds and two possible sub-rectangular examples in the Grendon complex, measuring respectively 86 m by 17 m and 116 m by 27 m. The first was without finds but pre-dated an Iron Age enclosure and had a fill more like those of Early Bronze Age ring ditches on the site than those of later features (D. Jackson 1995, 13, fig. 8; Gibson 1995a, 28); the second was almost equally devoid of finds, but enclosed a single pit which contained Neolithic Bowl pottery and was close to two others (Last 2005, 339–41). Cropmarks may suggest a possible example on the valley side beside the Southwick causewayed enclosure (Oswald *et al*. 2001, fig. 8.10), and another is represented by a square-ended cropmark enclosure measuring 30 m by at least 130 m and running at right-angles to the Nene at Hardingstone, 5 km downstream from Briar Hill (Northamptonshire SMR ap_id 044800020001).

Pits, and a great many of them, were the main features recognised at Fengate in the early twentieth century, in an area south and east of that later investigated. But, where these contained pottery, this was Peterborough Ware, Grooved Ware and Beaker (Abbott 1910; Leeds 1922). These later ceramics have continued to predominate among the fewer, more scattered pits subsequently excavated in the area (Garrow 2006, fig. 3.7). Despite the vast scale of excavation at Fengate, only two pits containing Neolithic Bowl pottery have been found, both of them isolated (Pryor 1980, 95, 104). In addition, two small features in the immediate area of the Padholme Road structure may conceivably be contemporary with it (Pryor 1974, fig. 5: F60, F67).

Some 2 km to the north of Fengate, however, at Parnwell (Fig. 6.1), was a cluster of 11 pits, almost certainly part of a larger concentration extending beyond the excavated area (Webley 2007). Seven of them were arranged in a V-plan. To the north-east of these was an exceptionally large pit with several fills, some of them dumped rather than silted. This feature contained the bulk of the Neolithic assemblage, although there were smaller quantities of the same suite of material in the others. The pottery was Mildenhall Ware comparable to the Etton assemblage; the lithics included two flakes from Group VI axeheads; the animal bone was mainly of cattle; and the charred plant remains included small amounts of cereals as well as much larger quantities of hazelnut shell. Pollen was sparse and badly preserved in a monolith taken from the large pit. Within these limitations, it indicates an open meadow or pasture environment, with some woodland or scrub. Charred hazelnut samples from two layers of this pit yielded two statistically consistent dates (*NZA-24076–7*; T'=0.0; T'(5%)=3.8; ν=1; Table 6.7), indicating a date of *3640–3495 cal BC* (*85% probability*; Fig. 6.28: *NZA-24077*) or *3435–3385 cal BC* (*10% probability*), probably of *3635–3565 cal BC* (*57% probability*) or *3535–3515 cal BC* (*11% probability*).

Pit digging seems to have been localised. Further up the Nene, there are scarcely any early Neolithic pits in addition to those already mentioned. Large-scale excavation at Raunds yielded only a small quantity of plain Bowl pottery, most of it redeposited (Tomalin forthcoming). Peterborough Ware was more frequent, as it is all along the valley, notably at the Ecton settlement (Moore and Williams 1975). Even the relatively few internal features in the Briar Hill enclosure almost all post-dated it (Bamford 1985, 44–6).

The palynology and soil micromorphology of the palaeosols beneath the fen deposits in the Peterborough area indicate a predominantly wooded environment with very slight evidence for agriculture prior to inundation, which began as late as the early second millennium cal BC in the deeper parts of the Flag Fen basin (French 2003; Scaife 2001). The alignment of monuments at Fengate argues, however, for at least local clearance in the fourth millennium cal BC, such as may be reflected in the pollen from the Parnwell pit.

6.4 The Lower Welland valley

6.4.1 Etton, Maxey, Cambridgeshire, TF 1385 0735; Etton Woodgate, Maxey, Cambridgeshire, TF 1365 0735; Northborough, Peterborough, Cambridgeshire, TF 1557 0845

Location and topography

All three sites form part of a group of at least six causewayed enclosures on the lower Nene and lower Welland, the largest cluster in Britain outside Wessex and the Cotswolds (Fig.

6.1; Oswald *et al*. 2001, 109–10, fig. 1.1). All have ovoid plans and are of similar size, none exceeding 3 ha, although they have varying numbers of circuits (Oswald *et al*. 2001, fig. 6.3). The Etton and Northborough enclosures lie less than 2 km apart, at approximately 8 m and 5 m OD, both on low gravel islands in the Welland floodplain, close to where the river enters what are now the Fens. Northborough is locally exceptional in having at least four circuits, and probably more, the most clearly visible ones grouped into two closely spaced pairs (Fig. 6.37; Oswald *et al*. 2001, fig. 5.16). The single circuit of the Etton enclosure (Fig. 6.29) was less than 1 km away from a smaller, unexcavated, single causewayed circuit to the south (Oswald *et al*. 2001, 149, fig. 6.3) and only 80 m away from Etton Woodgate to the west, where two lengths of ditch follow the edge of the Maxey gravel island (Fig. 6.35; Pryor 1998, fig. 4).

These three sites are the earliest elements in an extensive and long-lived monument complex (Pryor *et al*. 1985; Pryor 1995; 1998; French and Pryor 2005). The Etton and Maxey cursus monuments, on two slightly different north-west–south-east alignments, both ended in the area of the Etton enclosure, the Etton cursus actually traversing the monument. Subsequent developments included numerous small henge-like monuments, a larger henge, whose entrance encompassed an oval barrow, and countless round barrows.

The locations of the monuments were related intimately to the watercourses which dissected the area (French 1998a). The Etton enclosure was built in the northern apex of a meander of a channel, which separated it from Etton Woodgate. Because of the low-lying locations of both these sites, parts of their ditch bases had remained waterlogged from the fourth millennium to the time of excavation. Alluvium, deposited most massively from the later Roman period onwards (French 1998b; 1998c, 320), preserved an only slightly truncated palaeosol here and at Northborough, and ensured that the ditches and other features were not reduced by ploughing.

History of investigation

While cropmarks on Maxey island, at 9–10 m O.D. (Pryor *et al*. 1985, figs 21, 22), have long been known and investigated (RCHME 1960; Pryor *et al*. 1985; W. Simpson *et al*. 1993), a greater depth of alluvium over the lower-lying areas to the east (Pryor *et al*. 1985, fig. 3) was largely responsible for the much later recognition of the Etton enclosure, during aerial reconnaissance in the exceptionally dry summer of 1976 (Pryor 1998, 1), and of the enclosures to the south of it and at Northborough in the 1990s (Oswald *et al*. 2001, 149–50).

Etton. Following recognition of the enclosure by Steve Upex in 1976, a section cut in 1981 by Francis Pryor and some of the team then working at Maxey confirmed the Neolithic date of the enclosure and showed that the lower ditch fills were waterlogged (Pryor and Kinnes 1982). This swiftly led to almost total excavation of the ditch and interior, the principal exception being the southern edge of the circuit, which lay under the embankment of the Maxey Cut. Excavation took place between 1982 and 1987, sometimes in difficult conditions and against time, in step with quarrying (Pryor 1998, fig. 76). The results have been published in detail (Pryor 1998) and are summarised here.

The single-circuit enclosure was built in an area that had been cleared of trees for some time, close to wet fen and subject to freshwater flooding, apparently a deliberately chosen location, since better drained land was available on Maxey island immediately to the west. Grassland, pasture and arable were all present in the vicinity. The single ditch circuit enclosed an ovoid area of approximately 2.5 ha, with its long axis running east–west (Fig. 6.29). The most obvious entrance was in the north, where a causeway originally some 25 m wide corresponded to an internal gateway supported by two substantial slots. The line of the more westerly of these may have been extended by a fence which helped to demarcate a pit-free area to the south and east of the gate. As the channel next to which the enclosure was built migrated and invaded the north-west part of the ditch, the entrance was modified by narrowing the causeway so as to shift its centre farther east. The digging of two ditches which converged at the west side of the newly narrowed causeway was seen as part of the same process. One of them, F313, running south-west–north-east on higher ground than the north-west arc of the ditch, separated it from the rest of the interior. The other, running north–south, perpetuated the line of the east slot of the first entrance and extended it into the interior, where it was continued yet farther by a second fence (Fig. 6.29; Pryor 1998, 29, 98–100, 103–8, figs 103, 115, 359). Further axial entrances were inferred to the east, south and west (Pryor 1998, 101–2).

This east–west division of the interior corresponded to marked differences in the infilling of the east and west halves of the ditch. The segments of the western arc, close to and at one stage occupied by an active channel, contained much waterlogged organic material, including both woodworking debris and probable *in situ* coppice stools, and their upper fills seemed to have been washed in. Most of them had silted naturally, only a couple having been recut (Fig. 6.30). In the segments of the eastern arc, farther from the channel, there was little waterlogging, the predominantly sand and gravel fills underwent repeated recutting and backfilling, and placed deposits, often complex, of artefacts and animal bone extended to the ditch tops (Fig. 6.30). Successive stages in the ditch sequences were labelled 1A (initial deposits), 1B (subsequent recuts and backfilling) and 1C (final, linear recuts and deposits in the upper ditch fills).

There was no trace of any bank beside the segments of the eastern arc (Pryor 1998, 71) but a slight remnant was found adjacent to part of the western arc (French 1998c, 313, 325). Correspondingly, in the west of the enclosure, internal features were at least 3 m away from the inner edge of the ditch (apart from a probable entrance structure between segments 1 and 2), suggesting that the intervening space had been occupied by an earthwork. In the east, where

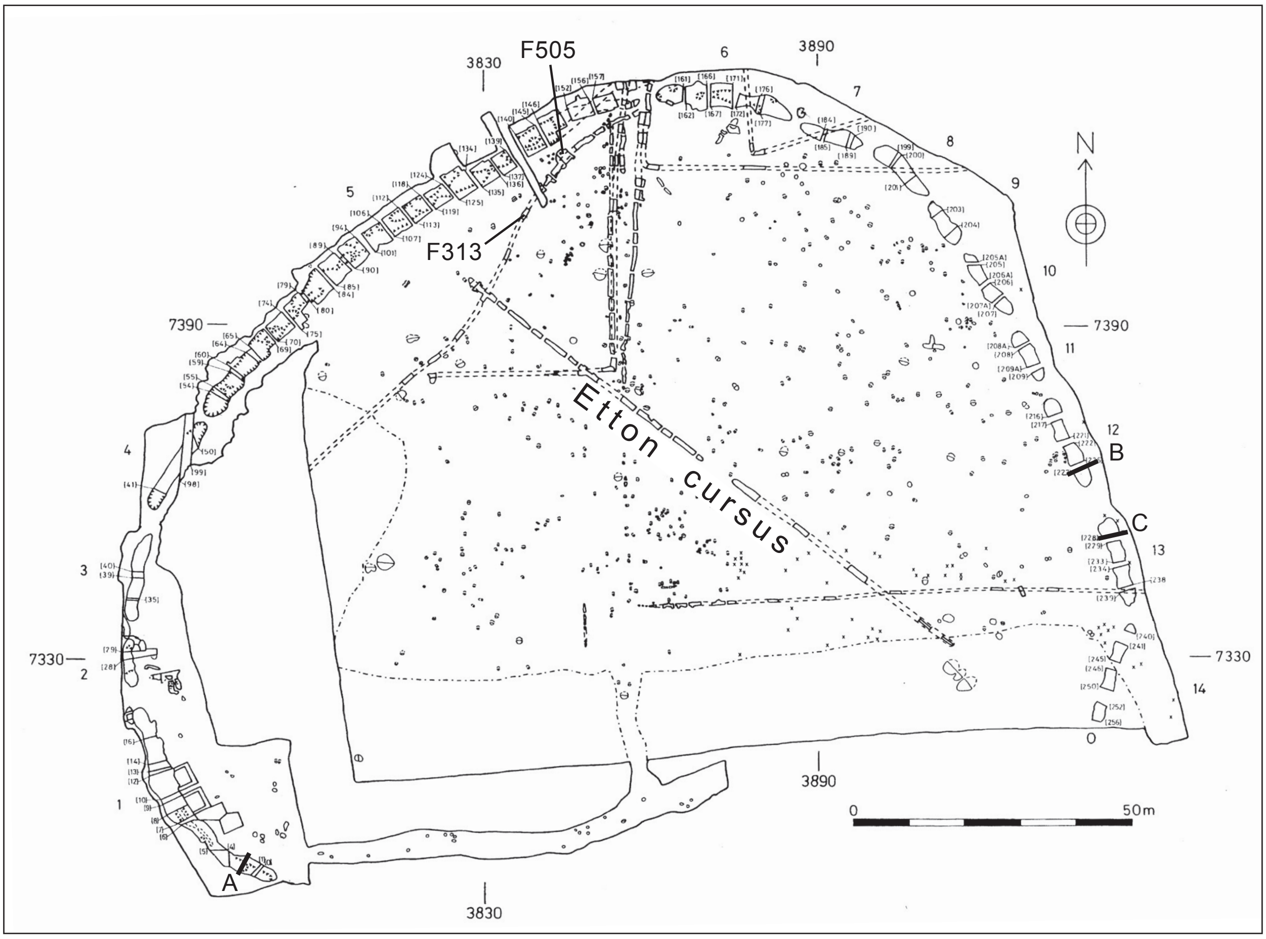


Fig. 6.29. Etton. Plan, showing excavated areas and location of sections shown in Fig. 6.29. After Pryor (1998, fig. 11).

sand and gravel were backfilled into the segments, internal features sometimes extended to the ditch edge, suggesting either that they were dug before any earthwork was built or after any earthwork had been returned to the ditches (Pryor 1998, fig. 102).

In the buried soil of the interior, lithics were more frequent in the west than the east (Pryor 1998, fig. 77), as were high phosphate values, from which image processing extracted an even distribution more compatible with the grazing of livestock than with the tightly localised highs and lows of settlement (Pryor 1998, 77–80, 355–6, figs 81–5). The frequency of dung beetles in the waterlogged insect fauna confirmed that animals were corralled within the enclosure (Robinson 1998). (Analysis of strontium isotope values in some samples of animal bone is now underway: Oliver Craig and Mark Edmonds, pers. comm.). Magnetic susceptibility was lower in the area beside the north-west segments cut off by F313 than immediately to the south-east (Pryor 1998, fig. 78). When the soil was stripped to its B and C horizons, magnetic susceptibility values were very high in an area of reddened gravel subsoil, which is likely to have been the site of intense burning which generated the burnt animal bone and other material deposited in nearby pits and ditch segments, producing further high values. This was separated by an area of only background susceptibility and few pits from a second area of enhanced susceptibility in the north-west, where, although burning had been less intense than in the east, many pits contained burnt animal bone (Pryor 1998, 76–7, 355, 358, fig. 79).

The abundant non-linear internal features were concentrated on the slightly higher ground south and east of F313 (Pryor 1998, fig. 102) and were almost all pits rather than postholes. Many of the better preserved examples contain selected and sometimes carefully placed and, by inference, symbolically charged deposits; charcoal staining and burnt animal bone were frequent (Pryor 1998, 353). A lack of intercutting, even among closely spaced features, indicates either that the pits were dug within a short span of time or that they remained visible (Pryor 1998, 354). Pits clustered near some ditch segments in the eastern arc and avoided others (Fig. 6.29; Pryor 1998, fig. 102). Features extended beyond the enclosure at the causeway between segments 12 and 13 (Pryor 1998, 11), but not uniformly around the circumference.

Numerous differences in depositional practice between the east and west sides of the enclosure prompted an interpretation of the west side as 'public' space, where acts such as feasting, ritual slaughter and exchange of livestock took place, and of the east side as 'private' space, reserved for smaller-scale personal or kin-group ceremonies, possibly funerary or commemorative (Pryor 1998, 353–4, 364–70). The period of the enclosure's construction

and initial use has yielded important collections of artefacts and environmental evidence. The waterlogged deposits provided both an exceptional suite of evidence for fourth millennium cal BC woodland management and woodworking (M. Taylor 1998) and a waterlogged insect fauna that illuminates both the environment and the use of the enclosure (Robinson 1998). Particularly noteworthy among the artefacts are an assemblage of Mildenhall Ware characterised by unusually elaborate and florid decoration and by the frequency of large vessels (Kinnes 1998; Pryor *et al.* 1998), and fired clay objects which resemble those of carved chalk from enclosures in Wessex and Sussex (Kinnes and Pryor 1998).

Subsequently, in phase 2, the Etton cursus was built across the enclosure, with one north-west terminal in the interior and the other immediately outside the western arc. Later depositional activity was on a diminished scale. The cursus ditches were extremely clean, although subsequent excavation of the east ditch outside the enclosure recovered small quantities of Late Neolithic/Early Bronze Age sherds from a recut (French and Pryor 2005, 46–9, 71). The enclosure was frequented by users of Peterborough Ware, Grooved Ware, Beaker and Early Bronze Age pottery, but far fewer pits were dug in the interior and recuts in the enclosure ditches were sporadic (Pryor 1998, 360). The later use of the enclosure had taken place alongside the construction and frequentation of henges and round barrows, such as had been long known on Maxey island, to the north and north-east, and of scattered but recurrent later Neolithic occupation in the same area (French and Pryor 2005; Pryor 1998, fig. 4).

Since 1998, excavations and watching briefs to the south and south-west of the enclosure by Northamptonshire Archaeology have revealed hundreds of pits, containing predominantly Peterborough Ware and Beaker pottery, smaller numbers containing plain Bowl, Grooved Ware or Early Bronze Age styles. They are at their densest near the enclosure, becoming less frequent as distance from it increases (Ian Meadows and Alex Gibson, pers. comm.).

Harris (2006) has discussed the performance of acts of deposition at Etton as a means of creating, sustaining and transforming individual identities, especially in the course of the rites of passage which Pryor sees as contained within the prescribed and separate space of the enclosure (1998, 267–8, 367).[2]

Etton Woodgate. The ditches here were recognised during overburden stripping in advance of gravel extraction in 1983 and were the subject of salvage excavation (Fig. 6.35; Pryor *et al*. 1985). They were interrupted by a 2.75 m wide entrance at the nearest point to the Etton enclosure. From this, one ditch ran north-east to end after 50 m without any perceptible continuation. The other ran south-west for at least 75 m. Both had silted naturally and their lower fills contained small quantities of early Neolithic artefacts, with axed woodworking debris and unmodified roundwood where the ditch bases were waterlogged (Fig. 6.35). No archaeological features were observed south-east of the entrance, towards the palaeochannel, but investigation of the higher ground to the north-west of the entrance led to the recovery of early Neolithic lithics from the palaeosol and the recognition of contemporary pits and postholes, one of the former containing a few scraps of poorly preserved human bone, the latter forming a rectangular structure (French and Pryor 2005, 17–23). Such features may have extended well beyond the area which it was possible to examine. The Bowl pottery is all plain, in contrast to the ornate Etton decoration, but this may be fortuitous since the total quantity is so small (Gdaniec 2005, 67). The entrance area was subsequently the site of a charcoal-rich, midden-like deposit and a complex of intercutting pits including a further inhumation, all of Beaker date.

Northborough. The four-circuit enclosure was discovered in 1996 during aerial reconnaissance by Jim Pickering, and was subsequently the subject of photogrammetric survey by RCHME (Oswald *et al*. 2001, fig. 5.16). In 2004 the Time Team commissioned a magnetometer survey, on the basis of which the two pairs of circuits were sectioned (C. Lewis 2005; Time Team 2005; Figs 6.37–8). Magnetic susceptibility was higher in the centre of the monument than between the two pairs of ditches, while phosphate levels were low outside the circuits and at their highest near one entrance and in the area immediately inside it, suggesting that cattle had been driven through the entrance into the enclosure. As at Etton, the site was covered by alluvium. No trace of any banks survived. Beaker occurred in the topmost fills. The ditch deposits were sampled for pollen by Rob Scaife. Although preservation was poor and only small numbers of pollen grains were present, the surrounding area seems to have been under grassland or pasture when the enclosure was built, with the possibility of nitrogen-rich soils and disturbed ground, possibly associated with grazing animals, in the secondary fills.

Previous dating at Etton

At Etton, time depth was inherent in the remodelling of the enclosure and the recutting of the segments, as well as in the pottery sequence. It was also clear that the enclosure, in its remodelled form, predated the Etton cursus. Seven radiocarbon dates were obtained by the British Museum Laboratory from samples from the enclosure ditch (Ambers 1998), using LSC and the methods described by Ambers and Bowman (1994). A further five dates (R. Hedges *et al*. 1996, 193–4) were obtained for a horse skull and antler pick found in a pit (F385) within the enclosure close to the cursus (Pryor 1998, 112, figs 118–19), by the Oxford Radiocarbon Accelerator Unit, using the methods described by Law and Hedges (1989) and R. Hedges *et al*. (1989a; 1992b).

Three of the dates from the enclosure were on samples from the initial fills of segments in the western arc (Table 6.8: BM-2723, -2765, -2889) and two more on samples from layers immediately overlying them (Table 6.8: BM-2724, -2890). All five were made either on waterlogged roundwood or on single, well preserved, disarticulated animal bones, and they formed a tight, statistically indistinguishable group. Ambers concluded that ‘the dates

for the enclosure ditch fall comfortably within the expected range for British causewayed enclosures and suggest that Etton is one of the earlier examples of this class of monument' (1998, 350). Pryor considered that 'such a close group of dates might be taken to indicate that Phase 1A was of short duration' (1998, 352). The remaining two dates (Table 6.8: BM-2891, -2899) were on samples from pits cut into the largely silted ditch. BM-2899, from a pit attributed to phase 1, suggested a potential span of some centuries for the original construction and use of the site. BM-2891, from a pit containing wooden bowls, seemed unacceptably late for the unabraded Peterborough Ware sherds which were also present (Pryor 1998, 352).

Of the five dates from F385, the pit containing a horse skull and an antler pick, the laboratory considered that one (Table 6.8: OxA-1031) should not be viewed as a reliable estimate of the age of the horse skull, because it had been made using a method of bone pre-treatment (Gillespie *et al*. 1986) subsequently found to give suspect results for bones from particularly wet contexts, such as would have obtained here during the later history of the site. OxA-1031 is therefore excluded from further consideration here. The consistency of the four remaining dates (Table 6.8: OxA-1311–4), the samples for which were treated using the ion-exchanged gelatin fraction that overcame some of the problems of the previous method, suggested that the measurements were valid (R. Hedges *et al.* 1996, 194). These late second millennium cal BC dates for the skull and antler would place the pit considerably later than its spatial relationship to the cursus had suggested (Pryor 1998, 110–12; Armour-Chelu 1996).

There were no pre-existing dates from Etton Woodgate or Northborough, where less complex fills and lower levels of artefacts might suggest shorter use-lives.

Reassessment and modelling of existing dates from Etton

One of the dates from the initial fills of the segments of the western arc of Etton (*BM-2889*) was made on roundwood fragments which must have been cut or broken off after no more than a few years' growth. Another (*BM-2765*) was measured on a pig tibia from which the unfused proximal epiphysis remained. Given that animal bones from Neolithic levels at Etton were recorded and bagged individually, this means that the shaft and epiphysis were together in the ground and were lifted together: in other words that they were still joined by soft tissue when buried, so that the animal from which they came could not have been long dead. These two measurements should thus be close in age to their contexts and are in fact statistically consistent (Table 6.8: T'=1.4; T'(5%)=3.8; ν=1). Consistency is maintained when the remaining result from the initial fills, on a disarticulated bone sample (*BM-2723*), is included (T'=3.3; T'(5%)=6.0; ν=2), suggesting that it too was freshly deposited. Of the two dates from immediately overlying layers, one (*BM-2890*) is on roundwood and the other on disarticulated bone (*BM-2724*). They are statistically consistent with each other (T'=1.5; T'(5%)=3.8; ν=1) and with the dates from the basal layers (T'=4.7; T'(5%)=9.5; ν=4). This confirms Pryor's initial impression of a short duration for phase 1A and suggests that, since the roundwood and pig tibia samples are unlikely to have been redeposited, all the samples were fresh when buried. These measurements can be modelled to indicate a construction date of *3935–3635 cal BC* (*95% probability*; Fig. 6.31: *build Etton*), probably of *3795–3655 cal BC* (*68% probability*).

BM-2899 and *-2891*, from later pits, both measured on roundwood and hence without significant age offsets, correspond to the artefactual evidence for continued but diminished activity throughout the fourth and third millennia cal BC. Given the small number of pre-existing measurements, these later results have been included in the phase of continuous activity associated with the enclosure (Fig. 6.31). The four results for the horse skull and antler pick in pit F385 (OxA-1311–4) are so consistent (Table 6.8: T'=0.4; T'(5%)=7.8; ν=3) that they cannot be disregarded, and the deposit must be taken as dating from the later second millennium cal BC. Remains of domestic horse in Britain are more securely documented from this period than from the fourth millennium cal BC (Serjeantson 1998). A contemporary human presence in the surrounding area is evidenced by an extensive, diffuse spread of Bronze Age lithics across Maxey island (Pryor 1985a) and by a ditched field system to the north-east. Roundwood from the basal fills of this has been dated to 1420–1120 cal BC (3040±45 BP; Q-3147; French and Pryor 2005). The spatial relationship of the pit to the cursus may reflect the continued visibility of the earlier monument.

Objectives of the dating programme

Apart from overall matters of chronology, sequence and duration, we posed many specific questions. Could the construction date of the Etton enclosure be refined from the existing 300-year period? How did the three sites relate to each other? Were they built sequentially or at indistinguishably close intervals? Did the simple stratigraphic sequences at Etton Woodgate and Northborough correspond to shorter use-lives than those reflected in sometimes complex histories of recutting and backfilling at Etton? At Etton, what timespan was occupied by phases 1B and 1C, intermediate between the already dated phases? Were there chronological differences between segments at Etton or between circuits at Northborough? And could the later fourth millennium and third millennium cal BC uses of the Etton enclosure be elucidated?

Sampling strategy and simulation

At Etton, there was an emphasis on finding series of samples running through the entire ditch sequence, preferably in single segments. The different histories of the two halves of the ditch made suitable samples more frequent in the basal levels in the western arc and in subsequent levels in the eastern. Waterlogged wood was confined to the western arc. Articulating and fitting bone samples were frequent. The sad loss of some records and finds in a fire at Flag Fen, and the unavailability of much of the woodworking

Table 6.8. Radiocarbon dates from Etton, Cambridgeshire. Posterior density estimates derive from the model defined in Fig. 6.33.

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Ditch								
OxA-14995	P387, P393, P394, P399, P400, P501, P502, P503	Carbonised residue from one of 7 joining Neolithic Bowl sherds forming a single fragment *c.* 11 x 15 cm	Segment 1 [13–14] (2). In an upper layer	4645±38	−27.7		3620–3350	*3520–3355*
OxA-14970	B505, B506	Sheep/pig fitting unfused vertebra and vertebral centrum	Segment 1 [15–16] (2). In an upper layer	4751±34	−21.0		3635–3380	*3640–3500* (*80%*) or *3430–3380* (*15%*)
OxA-14883	P94	Neolithic Bowl body sherd, probably from the same pot as second sherd from same context (P93)	Segment 1 [0–1] (8). In SE butt of segment, with complete pot on birch bark mat (Pryor 1998, 21). Bag of P94 marked 'associated with P90 – whole pot on mat'. L8 was on base of ditch (Pryor 1998, fig. 59: A), but this may not have been the first cut of the segment (Pryor 1998, 21)	4878±35	−28.5		3710–3630	*3705–3635*
GrA-29357	C14 (1)	Unidentified bark. 1 fragment 12 mm thick	Segment 1 [2–4] (8) c 6.15 m OD, 85 cm deep, 8784/7293. Extracted from roundwood twigs associated with wooden axe handle (W409) in basal layer (Pryor 1998, 21–4, 53–4, 148–9, fig. 59: B)	4875±40	−25.9		3710–3540	*3705–3635*
BM-2765	C14 (22)	Pig. Tibia. Replicate of OxA-14969	Segment 1 [2–4] (8). In basal layer with waterlogged wood and axe haft. (Pryor 1998, 21–4, 53–4, 148–9, fig. 59: B). Unfused epiphysis in bag marked '22' suggests that shaft and epiphysis were together in ground, and hence that the animal from which it came was recently dead	4960±90	−21.4	4830±33 T'=2.5; T'(5%)=3.8; ν=1	3660–3530	*3700–3635*
OxA-14969	C14 (22)/2	Pig. Unfused proximal tibia epiphysis from bag which formerly contained pig tibia which was sample for BM-2765. Replicate of BM-2765	Segment 1 [2–4] (8). In basal layer with waterlogged wood and axe haft (Pryor 1998, 21–4, 53–4, 148–9, fig. 59: B). The lifting and bagging of the shaft and epiphysis as a single find suggest that they were together in the ground, joined by soft tissue when buried, and hence that the animal from which they came was not long dead when the bone was buried	4809±36	−20.8			
BM-2724	C14 (23)	Cattle innominate	Segment 1 [5–6] (3) 3780/7297 96 cm deep. Near base of ditch, overlying layer 4+5 which was equivalent to layer 8 in [2–4] (Pryor 1998, 45–6, 63–4)	4920±70	−21.0 (estimated)		3940–3530	*3685–3520*
BM-2890	C14 (4)	Roundwood	Segment 1 [5–6] (3) 3780/7297. Near base of ditch segment, overlying layer 4+5 which was equivalent to layer 8 in [2–4] phase 1' peat deposit (Pryor 1998, 21–4, 53–4, 148–9)	4820±45	−28.7	4789±30 T'=0.8; T'(5%)= 3.8; ν=1	3650–3520	*3645–3615* (*16%*) or *3610–3520* (*79%*)
GrA-29358	C14 (4)	Roundwood fragment from undated remainder from sample for BM-2890	Segment 1 [5–6] (3), c. 6.20 m OD 3780/7297. Near base of ditch, overlying layer 4+5 which was equivalent to layer 8 in [2–4] (Pryor 1998, 45–6, 63–64, fig. 60)	4765±40	−26.5			

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-29368	B479	Cattle. One of a bundle of 20 ribs from both sides of the body of an animal which had died in the first year of life. Cut marks on some indicate detachment from the sternum and vertebral column (Armour-Chelu 1998a, 278)	Segment 1 [5–6] (3). Found as a bundle near base of ditch segment, overlying layer 4+5 which was equivalent to layer 8 in [2–4] (Pryor 1998, fig. 60: A, B)	4865±40	−22.5		3710–3530	*3675–3625* (*63%*) or *3590–3525* (*32%*)
BM-2899	C14 (5)	Roundwood	Segment 1 F40 (2) in [5–6] 3778/7298. In lower fill of pit cut into outer edge of ditch segment, with complete cushion quern or pounder (Pryor 1998, 21–4, 53–4)	4370±50	−27.1		3270–2890	
BM-2889	C14 (8)	Roundwood	Segment 3 [35–0] (3) 3766/7366. Close to butt end of ditch segment, in lowest layer (Pryor 1998, 25, 56–7, figs 135, 64: A)	4840±50	−27.6		3710–3520	*3665–3500* (*88%*) or *3430–3375* (*7%*)
GrA-29369	B5339	Sheep. L humerus articulating with ulna (B5342)	Segment 3 [35–0] (3) 6.48 m OD 3766/7338. In lowest fill of ditch (Pryor 1998, 25, fig. 64: A). Heaped in segment butt with 25 other bones from a single 3–4 year-old sheep, some of them butchered (Armour-Chelu 1998a, 278–9)	4810±40	−21.8		3660–3520	*3665–3515*
OxA-15033	C14 (7)	*Quercus* sp. 1 fragment sapwood, 1 too degraded for its maturity to be assessed	Segment 3 [35–0] (3) 6.48 m OD 3766/7338. In lowest fill of ditch (Pryor 1998, 25, fig. 64: A). The small diameter of the twigs shows that they were only a few years old when buried	4673±33	−26.3		3630–3360	*3625–3600* (*4%*) or *3525–3365* (*91%*)
OxA-15039	B5356	Pig. Cervical vertebra with unfused epiphysis and cut marks	Segment 3 [40–0] (3) 6.46–6.53 OD. Layer on base of ditch (Pryor 1998, fig. 64: C)	4785±30	−21.2		3650–3510	*3645–3515*
BM-2723	C14 (26)	Cattle tibia	Segment 5 [125–130] (3). Near base of ditch segment, overlying stream channel (Pryor 1998, 26–9, 61, fig. 69:C)	4730±90	−23.6		3700–3340	*3655–3355*
BM-2891	C14 (10)	Roundwood. Cleaned remainder of sample includes twigs as little as 4mm in diameter, as well as more substantial fragments	Segment 6 [174–176] (6) 3878/7428. Fill of pit F953 which contained fragments of 4–5 alderwood bowls and Peterborough Ware sherds and (Pryor 1998, 29–30, fig. 71: B)	3680±35	−26.0		2200–1950	
OxA-14971	B9700	Caprine. One of 3 lumbar vertebrae (the others being B9701 and B9709), found articulated with each other and sacrum (B9710) Recent fusion of epiphyses indicates that the animal was almost mature (Armour-Chelu 1998a, 279)	From the same context as BM-2891	3528±31	−21.9		1950–1750	
GrA-29353	P2391B	Thick, fresh internal residue from 1 of 2 fresh, well preserved sherds from an Ebbsfleet Ware vessel	Segment 10 [0–205] (2). From the lower part of a rich deposit of cultural material, in one of the pits of F994, a complex deposit in the upper part of the segment (Pryor 1998, 41, fig. 44:E)	4410±40	−29.4		3330–2910	*3350–3210*
OxA-14973	B13914	Caprine. Pair of mandibles from sheep aged 18 months to 2 years (Armour-Chelu 1998a, 280–1)	Segment 12 [227–0] (6). Found together, in group of 6 bones, including vertebrae, probably from same sheep, in lens of turf within gravel fills on base of S butt (Pryor 1998, fig. 74: C)	4836±36	−21.9		3700–3530	*3695–3625* (*52%*) or *3595–3525* (*43%*)

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-29354	P3750	Carbonised residue from shell-tempered body sherd	Segment 12 [217–221] (3). Middle fill of phase 1C recut (Pryor 1998, 19, fig. 74: B)	4560±45	−29.0		3500–3090	*3500–3430* (*15%*) or *3380–3260* (*71%*) or *3255–3175* (*9%*)
OxA-14972	P3821A	Exceptionally fresh and thick internal carbonised residue from large shell-tempered body sherd. Replicate of GrA-29355	Segment 12 [227–0] (2). Layer overlying phase 1C recut in S butt of segment (Pryor 1998, fig. 74: C)	4300±36	−28.1	4267±27 T'=1.9; T'(5%)=3.8; ν=1	2920–2870	
GrA-29355	P3821B	Replicate of OxA-14972	From the same context as OxA-14972	4225±40	−28.8			
GrA-29372	B15481, B15500	Cattle. 2 articulating phalanges	Segment 13 [228–0] (5) at 105 cm deep. Layer overlying L7 and underlying layer 3 in N butt (Pryor 1998, fig. 75: A). Found at same depth and same grid reference. This strongly suggests that they were still linked by soft tissue when buried and that the animal from which they came was not long dead	4740±40	−22.2		3640–3370	*3640–3490* (*89%*) or *3455–3445* (*1%*) or *3435–3400* (*5%*)
GrA-29367	P3596	Carbonised internal residue from large, well preserved, shell-tempered Neolithic Bowl body sherd, which was one of at least 10 probably from the same pot	Segment 13 [239–0] (6) at 85 cm deep. In S butt (Pryor 1998, fig. 56: H). NB The notations used here are from the bag. In the figure caption the layer is 4	4665±40	−28.0		3630–3360	*3525–3360*
Internal features								
OxA-14974	C14 (18)-B	Roundwood fragment, collapsed and with insufficient structure for identification	F505 (6) 3844/7429 55–60 cm. Basal layer of the recut of a large pit just inside N apex of site (Pryor 1998, 98–99. figs 99, 104), cut by ditch F313 which was in turn cut by the Etton cursus. Bone deposit at base of pit, with some waterlogged twigs and Mildenhall Ware, covered with layers of loose backfilled gravel, extending to surface	4539±37	−27.6		3370–3090	*3490–3470* (*1%*) or *3375–3260* (*94%*)
GrA-29359	C14 (18) A	Roundwood fragment. Structurally collapsed and degraded, but possibly *Alnus glutinosa*, *Corylus avellana*, *Salix*/*Populus* sp.	From the same context as OxA-14974	4480±40	−26.4		3360–3010	*3360–3200*
OxA-1031	B2213	Horse skull	F385. Found with antler pick in pit in enclosure interior, close to cursus (Pryor 1998, 110–12, 282–3)	1440±100			-	
OxA-1314	2213.1	Horse tooth	From the same skull as the sample for OxA-1031	3050±80		3045±56 T'=0.0; T'(5%)= 3.8; ν=1	1440–1120	
OxA-1313	2213.0	Horse tooth	From the same skull as the sample for OxA-1031	3040±80				
OxA-1311	1948.1	Red deer antler pick. Replicate of OxA-1312	From the same context as the sample for OxA-1031	3080±80		3042±48 T'=0.4; T'(5%) =3.8); ν=1	1430–1120	
OxA-1312	1948.2	Replicate of OxA-1311	From the same context as the sample for OxA-1031	3020±60				

debris and wooden artefacts, introduced difficulties. Once a pool of suitable samples was identified, simulations like that shown in Fig. 6.32 were run to determine how many samples it would be necessary to date to achieve an optimal level of precision. This strategy was somewhat sabotaged by scarcity of suitable samples from the upper levels and by variable collagen preservation in the bone which rendered some samples undatable. Eight bone and antler samples and one carbonised residue sample from Etton failed to date, as did the only bone sample from Northborough. At Etton Woodgate and Northborough, the excavations have been so limited that all suitable samples were dated.

Results

Twenty additional radiocarbon determinations were obtained from Etton, with three from Etton Woodgate and seven from Northborough, one on a sample submitted by Wessex Archaeology in the course of post-excavation analysis. Details of all of them are given in Tables 6.8–10.

Analysis and interpretation

6.4.2 Etton

In segment 1 on the west side (Fig. 6.30: section A; Fig. 6.33), three samples were dated from the lowest layer in the south of the segment, which was waterlogged (Pryor 1998, figs 59–60). A replicate determination (OxA-14969) was obtained on the epiphysis remaining from the pig tibia dated by BM-2765. The two measurements are statistically inconsistent (Table 6.8: T'=6.9; T'(5%)=3.8; ν=1). Their mean is nonetheless statistically consistent with the results for the other two samples from this context, a residue on a Bowl sherd (OxA-14883) and a fragment of unidentified waterlogged bark (Table 6.8: GrA-29357; T'=0.0; T'(5%)=6.0; ν =2). For this reason, the measurements on the tibia have been combined before incorporation in the model (Fig. 6.33: *C14* (*22*)). Farther north in the same segment, six measurements were made on samples from layers above the ditch base. BM-2890, on a bulk sample of waterlogged roundwood, was replicated by GrA-29358, the two producing statistically consistent measurements (Fig. 6.33: *C14* (*4*); T'=0.8; T'(5%)=3.8; ν=1). In addition to these, there were carbonised residue from one of several joining Neolithic Bowl sherds (*OxA-14995*), the two fitting, unfused parts of a single vertebra (*OxA-14970*), one of a bundle of 20 ribs from the same juvenile cow (Pryor 1998, fig. 16; *GrA-29368*), and a cattle pelvis fragment (*BM-2724*). All provided dates which are in good agreement with the stratigraphic sequence. Roundwood from the base of F40, a small pit cut into the outer edge of the segment (Pryor 1998, figs 14–15), provides the latest sample in this sequence (BM-2899). This may relate to the later use of the site.

In segment 3, two samples of waterlogged roundwood (Fig. 6.33: *BM-2889, OxA-15033*), a vertebra with a fitting unfused epiphysis (*OxA-15039*), and an articulating bone sample heaped with other bones from a single sheep (Armour-Chelu 1998a, 278–9; *GrA-29369*) were dated from the basal layer.

In segment 5, a disarticulated cattle tibia from near the base (Pryor 1998, fig. 69: C) was dated (*BM-2723*). This date shows good agreement with its stratigraphic position in the model (Fig. 6.33).

In segment 6 (Table 6.8) both samples came from pit F953, which was cut into the segment and contained fragments of four or five alderwood bowls (M. Taylor 1998, figs 165–8). Roundwood (BM-2981) and a cattle vertebra found articulated with others (OxA-14971) provided statistically inconsistent dates (T'=14.5; T'(5%)=3.8; ν=1). Both, however, demonstrate an Early Bronze Age date for the pit and show that Peterborough Ware sherds from it (Pryor 1998, 29–30) were redeposited. The feature represents reuse of the site and is not included in the model.

On the east side, in segment 10, carbonised residue was dated from one of two fresh, well preserved sherds from an Ebbsfleet Ware vessel (Fig. 6.33: *GrA-29353*) from near the base of a rich deposit of artefacts, animal bone and burnt material, including Mildenhall Ware, in the upper fill of the ditch (Pryor 1998, 38–45, fig. 44:E). Because this sample formed part of a major deposit of cultural material it clearly derives from the main use of the enclosure and is included in the model on that basis.

Segment 12 (Fig. 6.30: section B) provided a sequence of three samples (Fig. 6.33). *OxA-14973* was measured on a pair of mandibles found together (i.e. still joined by soft tissue) with other bones probably from the same sheep in a turf lens just above the base of the ditch, within the initial gravel fills. Carbonised residue from sherds from successive overlying layers respectively provided a single measurement, *GrA-29354* and a statistically consistent pair of replicates (GrA-29355, OxA-14972; Fig. 6.33: P3821; T'=1.9; T'(5%)=3.8; ν=1). This sample came from layer 2 in section 227, which overlay a slot-like phase 1C recut and was separated from it by a skin of iron pan, suggesting that the surface of the fill had consolidated before layer 2 was deposited (Fig. 6.30: section B; Pryor 1998, fig. 74: C) and hence that some time had elapsed. For this reason, the sample is treated as part of the later use of the site and is excluded from the model.

In segment 13 (Fig. 6.30: section C), two articulating cattle phalanges were dated from a layer above the initial fill (Fig. 6.33: *GrA-29372*) and residue on one of several sherds from the same pot was dated from a higher level (*GrA-29367*).

The base of a recut of F505/F563, a large pit at the west side of the original, wider north entrance, containing much animal bone and some Mildenhall Ware (Pryor 1998, 98–9, figs 99, 104), provided two statistically consistent measurements on roundwood samples (OxA-14974; GrA-29359; T'=1.2; T'(5%)=3.8; ν=1). These provide *a terminus post quem* for ditch F313, which cut the pit, for ditch F363, which converged with F313, and for the Etton cursus, which cut F313 (Fig. 6.29; Pryor 1998, 106, fig. 115). F313 and F363 reflect continued use of the enclosure. Both ran to one

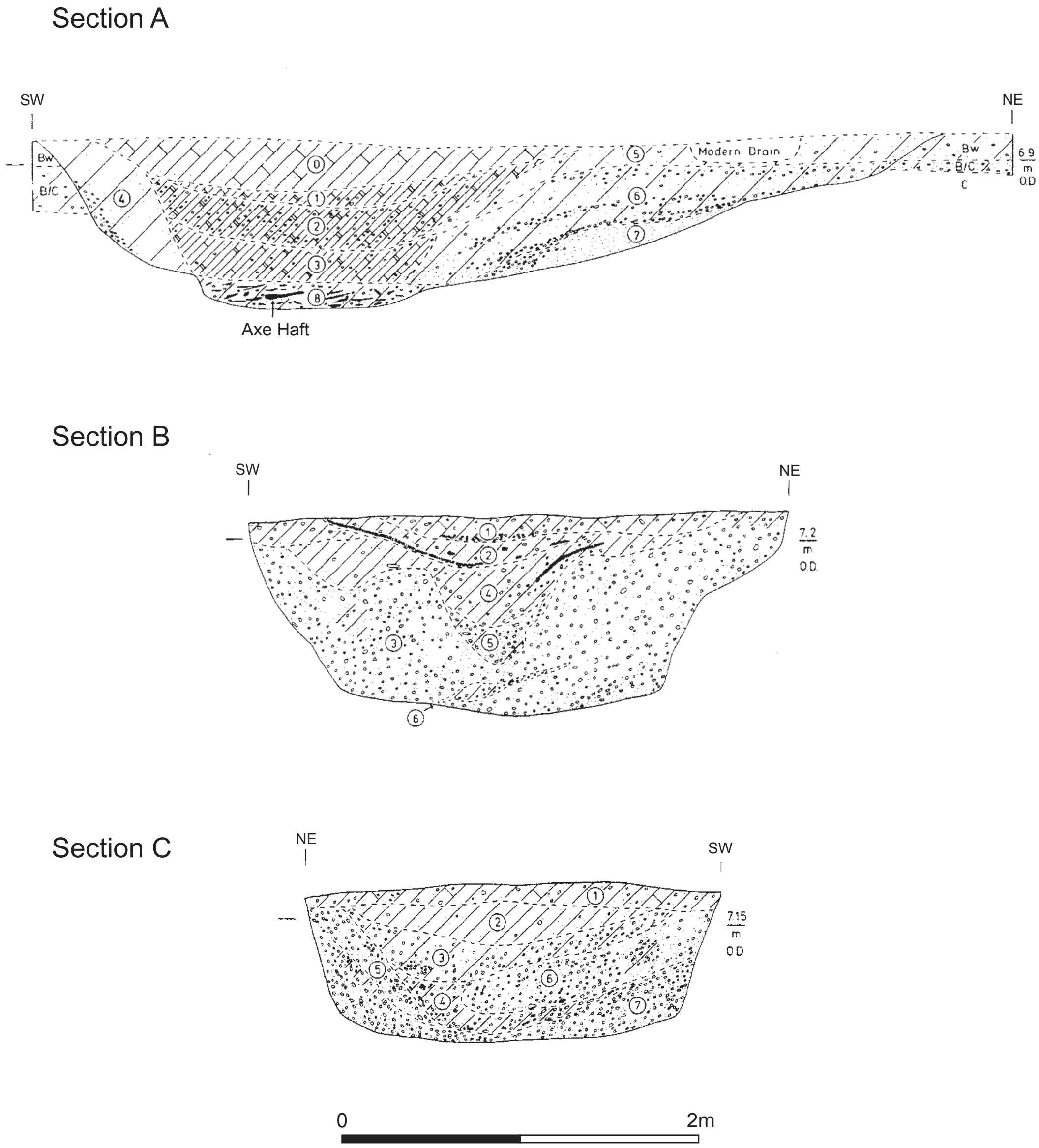


Fig. 6.30. Etton. Sections across segments 1, 12 and 13. After Pryor (1998, figs 59:B, 74:C, 75:A).

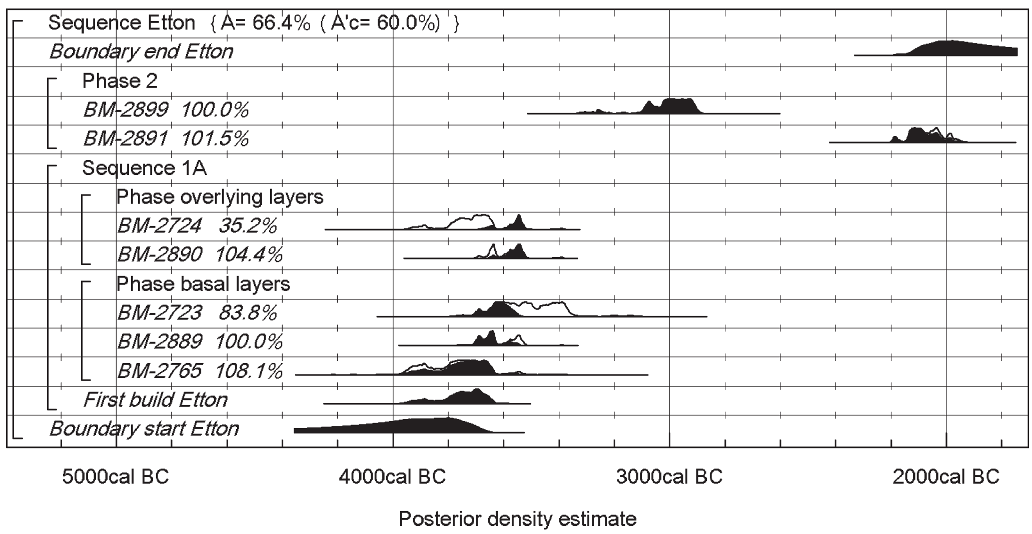


Fig. 6.31. Etton. Probability distributions of dates available in 1998, incorporating the stratigraphic sequence of fills within the ditch. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

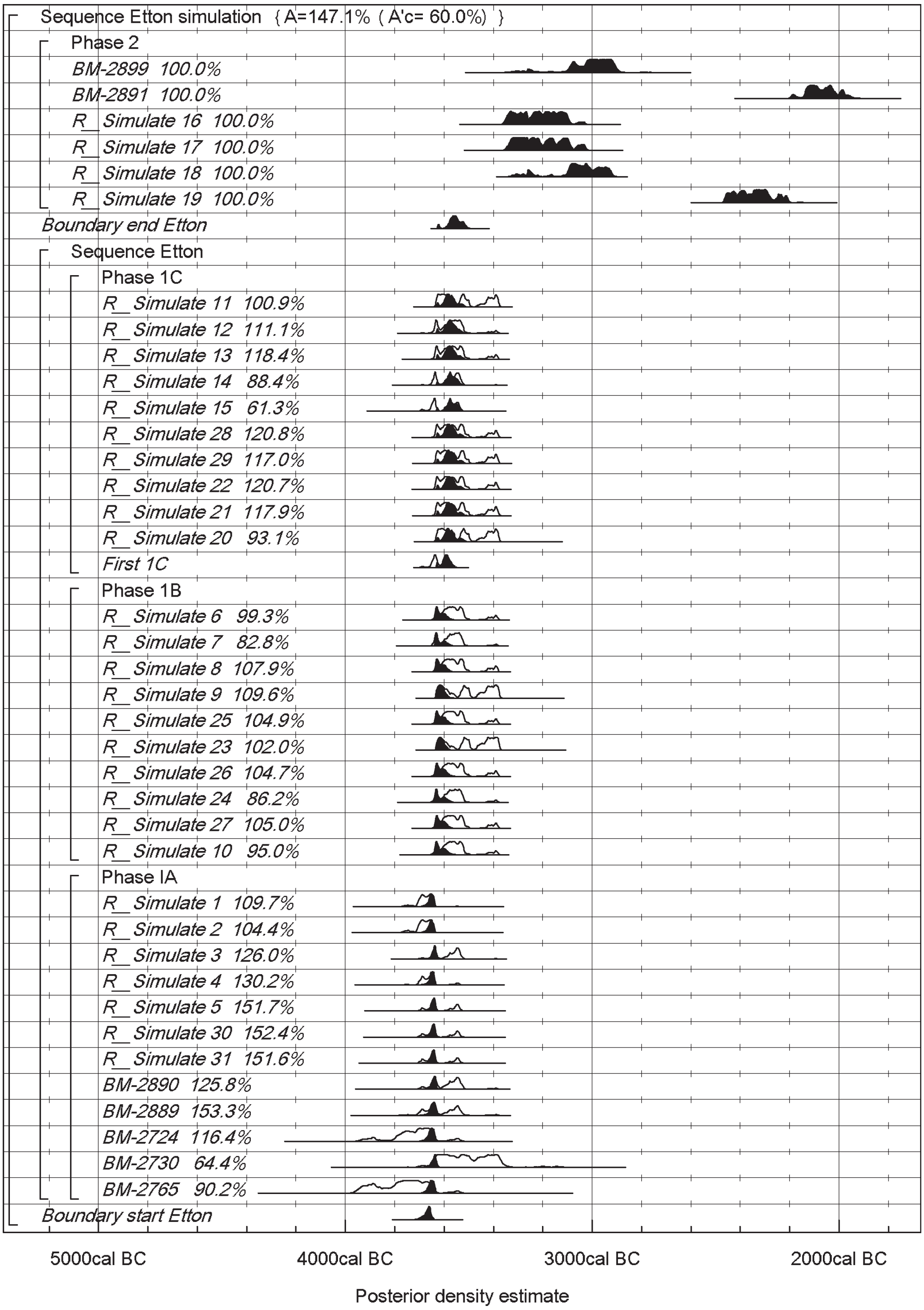


Fig. 6.32. Etton. Probability distributions of dates available in 1998, with simulated results from additional samples considered for dating. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

side of the modified, narrower north entrance, and F363 redefined a north–south boundary through the enclosure previously marked by a fence and one of the slots of the original entrance (Pryor 1998, 99–102, fig. 103). The pit recut, with the two ditches, is therefore treated as part of the main use of the enclosure.

The model shown in Fig. 6.33 suggests that Neolithic activity at Etton started in *3775–3650 cal BC* (*95% probability*; Fig. 6.33: *start Etton*), probably in *3725–3670 cal BC* (*68% probability*). From the first dated material, which is from the bottom of segment 1, it can be estimated that the ditch was cut in *3710–3645 cal BC* (*95% probability*; Fig. 6.33: *build Etton*), probably in *3705–3670 cal BC* (*63% probability*) or *3665–3655 cal BC* (*5% probability*). The difference between these estimates suggests that there are insufficient radiocarbon determinations from the site

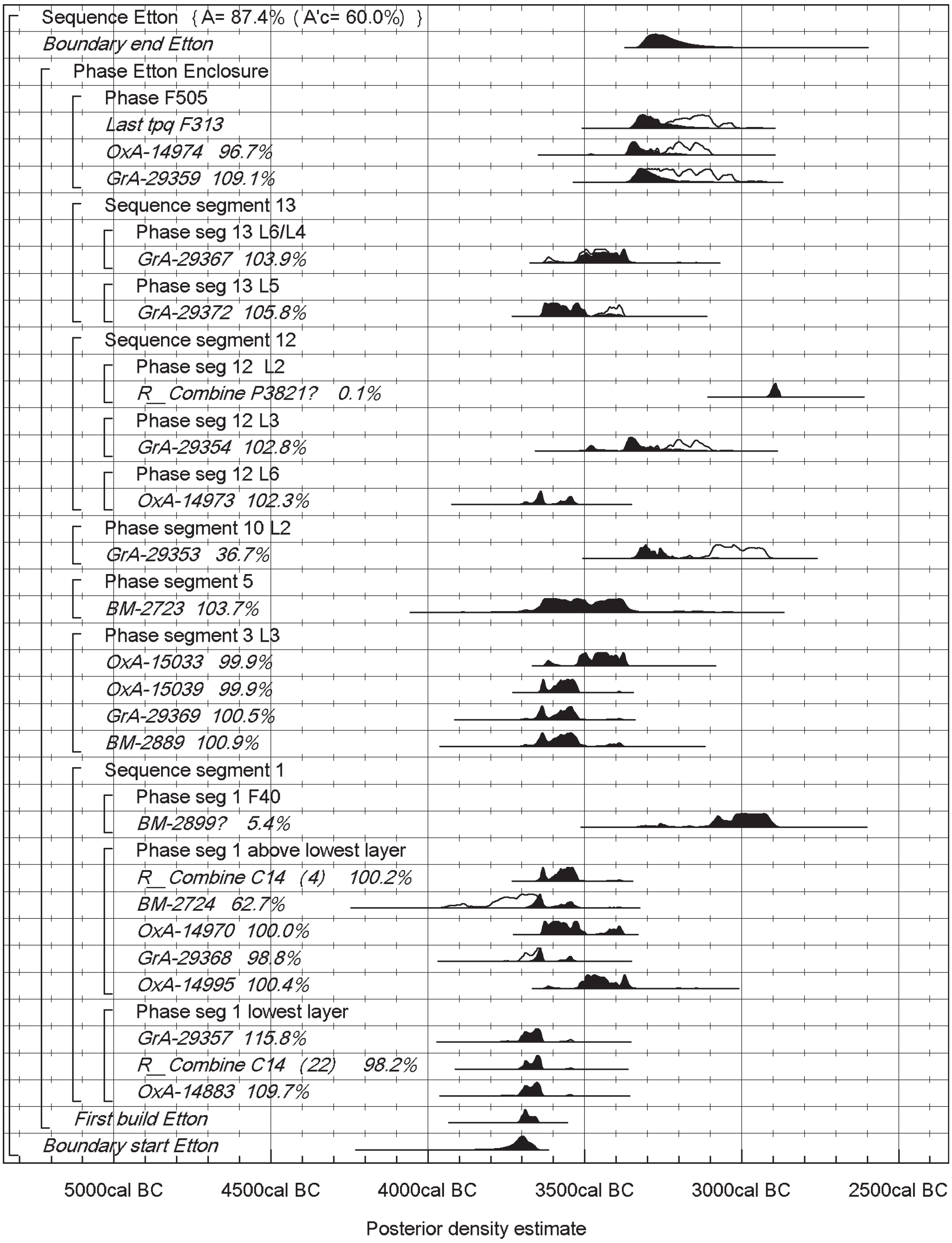


Fig. 6.33. Etton. Probability distributions of dates. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

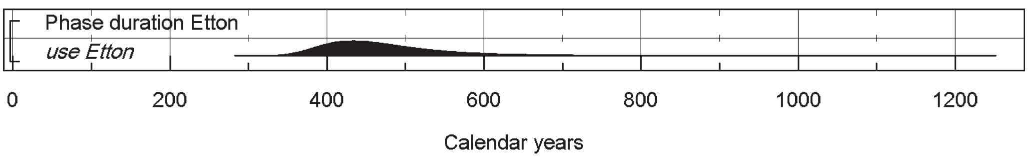
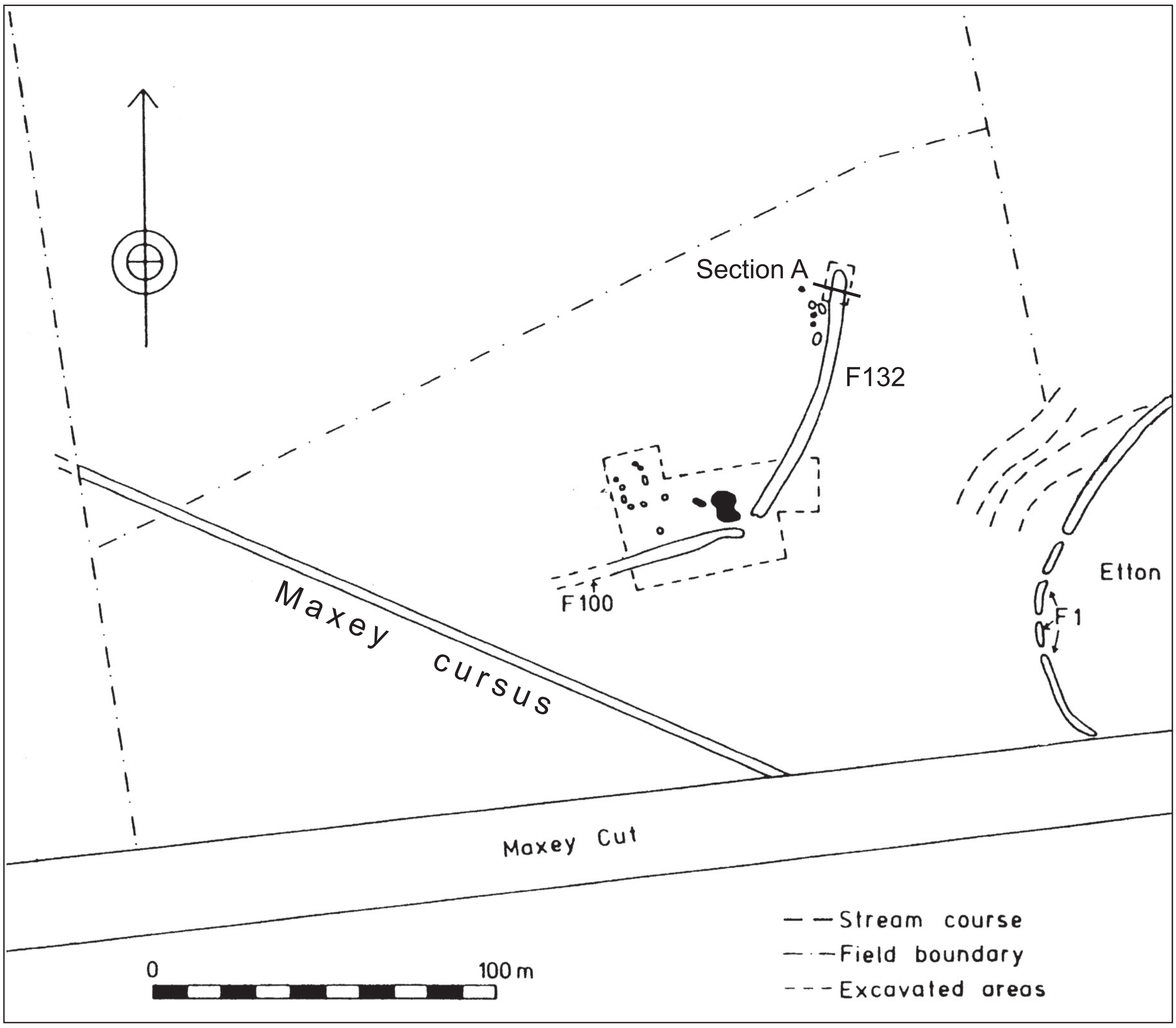


Fig. 6.34. Etton. Number of years during which the enclosure was in primary use, derived from the model defined in Fig. 6.33.

to entirely counteract the statistical scatter on the dates (Bayliss *et al*. 2007a; Bronk Ramsey 2000; Steier and Rom 2000; and see Chapter 2.2), a result of the fact that nine of the samples submitted failed. The primary use of the enclosure ended in *3330–3095 cal BC* (*95% probability*; Fig. 6.33: *end Etton*), probably in *3310–3210 cal BC* (*68% probability*). Overall, the initial use of the enclosure lasted for *345–635 years* (*95% probability*; Fig. 6.34: *use Etton*), probably for *380–510 years* (*68% probability*).



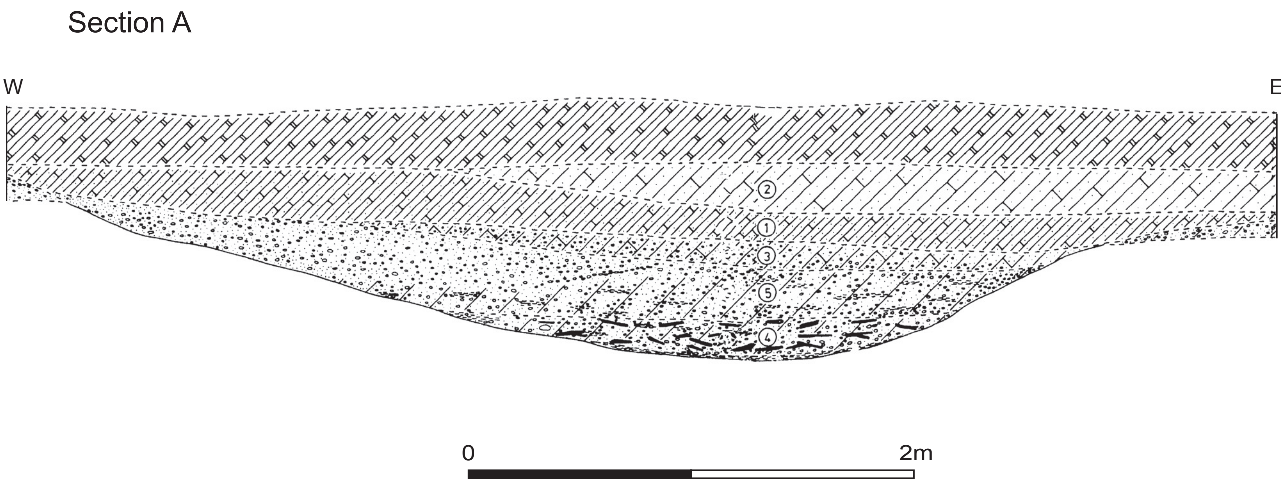


Fig. 6.35. Etton Woodgate. Plan showing its relation to Etton causewayed enclosure and the Maxey cursus, with section of N terminal of ditch F132. After French and Pryor (2005, figs 9, 13).

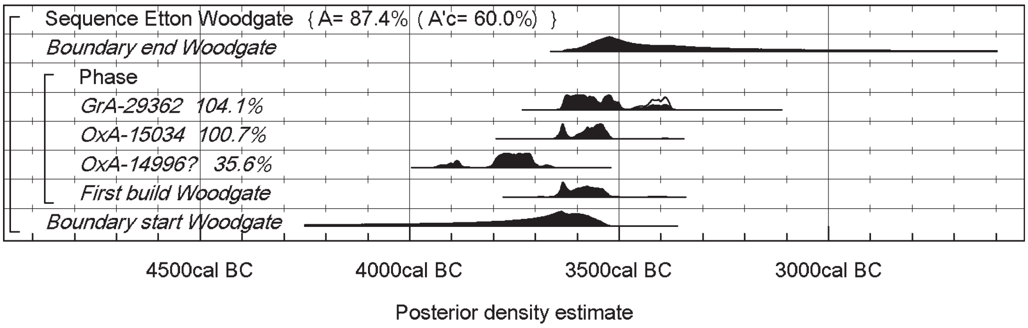


Fig. 6.36. Etton Woodgate. Probability distributions of dates. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

6.4.3 Etton Woodgate

Three samples have been dated, all from the waterlogged base of the north butt of F132, the more easterly of the two ditches (Figs 6.35–6). Two statistically consistent measurements have been obtained on fragments of roundwood (Fig. 6.36: *OxA-15034, GrA-29362*; Table 6.9: T'=1.3; T'(5%)=3.8; ν=1). A further measurement, OxA-14996, from residue on a sherd, is significantly earlier (T'=25.8; T'(5%)=6.0; ν=2). It seems more plausible that the sherd was redeposited than that both roundwood fragments were intrusive. OxA-14996 is therefore excluded from the model.

The model shown in Fig. 6.36 suggests that activity here began in *4155–3530 cal BC* (*95% probability*; Fig. 6.36: *start Woodgate*), probably in *3800–3540 cal BC* (*68% probability*). From the roundwood samples it can be suggested that the ditch was cut in *3645–3525 cal BC* (*95% probability*; Fig. 6.36: *build Woodgate*), probably in *3640–3620 cal BC* (*16% probability*) or *3605–3540 cal BC* (*52% probability*). Since only samples from the base of the ditch have been dated, it is not possible to reliably estimate when the ditch went out of use nor for how long it was in use.

6.4.4 Northborough

In the innermost ditch, two short-lived charcoal fragments were dated from a small, compact deposit of charcoal and degraded sherds on the centre of the ditch floor (Figs 6.37–8). These produced statistically consistent measurements (Fig. 6.39: *OxA-14469*, *GrA-29141*; Table 6.10: T'=0.3; T'(5%)=3.8; ν=1). In another section through the same ditch, the middle fill of a recut made in a largely infilled segment contained a discrete deposit of charcoal and burnt clay. Two short-lived charcoal fragments from this deposit were dated, yielding statistically consistent measurements (Fig. 6.39: *OxA-14470*, *GrA-29242*; T'=0.0; T'(5%)=3.8; ν=1).

A terminus ante quem for the digging of the outermost ditch is provided by measurements on charred hazelnut shell fragments from a concentration of nutshells with a little charred grain in a probable recut in the largely infilled ditch. The three measurements are statistically inconsistent (Table 6.10: T'=13.9; T'(5%)=6.0; ν=2). *NZA-21960* is significantly earlier than two other consistent measurements (Fig. 6.39: *OxA-15325*, *GrA-30076*; T'=2.0; T'(5%)=3.8; ν=1). Unfortunately, a substantial aurochs femur fragment from the ditch base contained insufficient collagen for dating.

The model shown in Fig. 6.39 suggests that the Northborough enclosure was initiated in *3700–3550 cal BC* (*95% probability*; Fig. 6.39: *start Northborough*), probably in *3645–3585 cal BC* (*68% probability*). The innermost circuit was built in *3640–3555 cal BC* (*95% probability;* Fig. 6.39: *build Northborough innermost*), probably in *3630–3585 cal BC* (*68% probability*). After this ditch had infilled, *1–50 years* (*95% probability*; Fig. 6.40: *fill innermost*), probably *1–20 years* (*68% probability*), elapsed before it was recut (Fig. 6.39). This happened in *3610–3525 cal BC* (*95% probability*; Fig. 6.39: *recut Northborough innermost*), probably in *3590–3545 cal BC* (*68% probability*). Charred hazelnut shell from a fill of a recut in the outermost ditch provides a *terminus ante quem* for both the recut and the original digging of the ditch of *3640–3530 cal BC* (*95% probability*; Fig. 6.39: *taq Northborough outermost*), probably of *3620–3565 cal BC* (*68% probability*). If the redeposited hazelnut shell from this deposit was reworked from the initial use of the ditch, it is possible that this circuit may have originated in the earlier part of the 37th century cal BC (Fig. 6.39: *NZA-21960*). This model also suggests that the use of the enclosure ended in *3605–3430 cal BC* (*95% probability*; Fig. 6.39: *end Northborough*), probably in *3580–3510 cal BC* (*68% probability*).

Overall, the Northborough enclosure was in use for *1–220 years* (*95% probability*; Fig. 6.40: *use Northborough*), probably for *10–115 years* (*68% probability*). When assessing the reliability of these estimates it should be noted that the total of radiocarbon determinations is small and that the remaining circuits are undated.

Implications for Etton, Etton Woodgate and Northborough

Figure 6.41 provides a summary of the construction dates for individual circuits of the three monuments considered here. Etton seems to have been built in the first half of the 37th century cal BC (Fig. 6.41: *build Etton*). Etton Woodgate was built later (*99.9% probable*). The date of

Table 6.9. Radiocarbon dates from Etton Woodgate, Cambridgeshire. Posterior density estimates derive from the model defined in Fig. 6.36.

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-29362	EW83 C14 (13)-A	Roundwood fragment, 15 mm diameter, too degraded to identify	F132 [1-2] (4) 6.50 m OD 3710/7420. Near the N butt of segment F132, in a layer lying on the ditch base containing axed woodchips, rods and unmodified roundwood (Taylor 1998, 159). The fragments must result from nearby woodworking soon after the ditch was dug, and the small diameter of the roundwood means that it was not more than a few years old	4740±40	−27.6	3640–3370	*3640–3495* (*83%*) or *3435–3375* (*12%*)
OxA-15034	EW83 C14 (13)-B	*Alnus glutinosa*. 1 radial segment of roundwood	From the same context as GrA-29362	4800±33	−29.5	3650–3520	*3650–3615* (*17%*) or *3610–3520* (*78%*)
OxA-14996	EW83 P806	Carbonised internal residue from Neolithic Bowl body sherd	From the same context as GrA-29362	4985±34	−24.9	3940–3660	

Table 6.10. Radiocarbon dates from Northborough, Cambridgeshire. Posterior density estimates derive from the model defined in Fig. 6.39.

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Innermost ditch							
GrA-29141	B 107/14	*Alnus glutinosa*. Roundwood charcoal, not from the same twig as the sample for OxA-14469	Context 107. In ditch 108, part of the innermost of 4 or 5 concentric circuits. Small, compact deposit of charcoal and degraded sherds on the centre of the ditch floor. Stratified below samples from context 207 but in a different trench. From same bulk sample as the sample for OxA-14469	4710±50	−27.4	3640–3360	*3635–3550*
OxA-14469	C 107/14	cf. *Alnus glutinosa*. Fragment of knotted twigwood charcoal. Not from the same twig as the sample for GrA-29141	From the same context and the same bulk sample as the sample for GrA-29141	4743±37	−26.8	3640–3370	*3635–3550*
GrA-29142	D 207/2	*Alnus glutinosa*. Roundwood charcoal	Context 207. In ditch 210, part of the innermost of 4 to 5 concentric circuits. Discrete deposit of charcoal and reddish-brown burnt clay in middle fill of recut made in largely silted ditch, sealed by infilled bank material. Stratified above samples from context 107 but in a different trench. From same bulk sample as the sample for OxA-14470	4800±45	−26.1	3660–3380	*3605–3520*
OxA-14470	A 207/2	Pomoideae. Small roundwood charcoal, *c.* 7 years growth	From the same context and the same bulk sample as the sample for GrA-29142	4795±38	−27.4	3660–3510	*3605–3520*
Outermost ditch							
NZA-21960		Joining fragments from single hazelnut shell	Context 722(7). In ditch 720, from concentration of 30+ charred hazelnut fragments with occasional charred grain in fill of a recut, in uniform condition	4877±25	−25.6	3710–3630	*3700–3635*
OxA-15325	720 (722) A	Single fragment of charred hazelnut shell	From the same context and the same bulk sample as NZA-21960	4784±33	−26.2	3650–3390	*3640–3620* (*7%*) or *3615–3520* (*88%*)
GrA-30076	720 (722) B	Single fragment of charred hazelnut shell	From the same context and the same bulk sample as NZA-21960	4710±40	−22.5	3640–3360	*3635–3545*

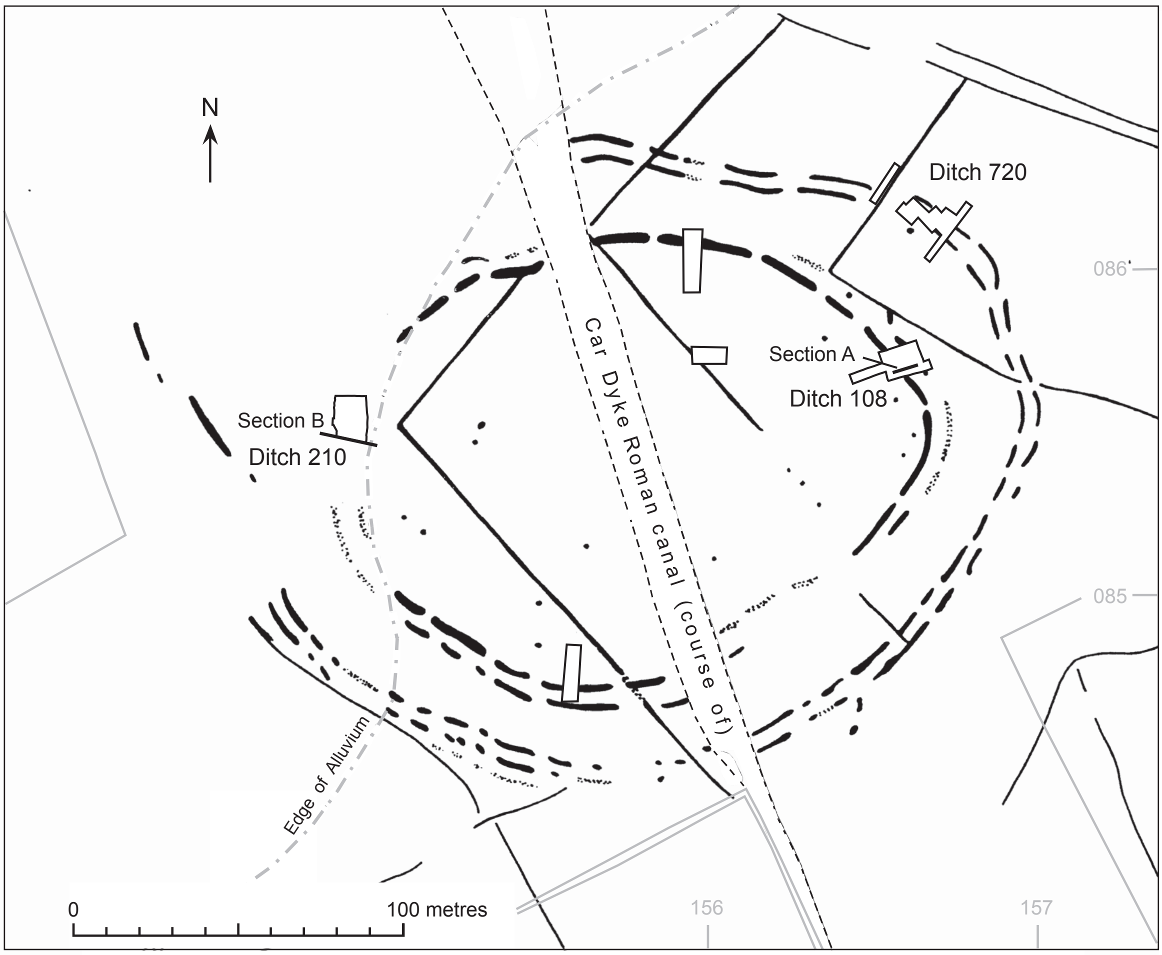


Fig. 6.37. Northborough. Air photograph transcription with location of trenches. After Oswald et al. *(2001, fig. 5.16) with further information from Wessex Archaeology.*

Northborough is less clear cut. The innermost circuit was built after Etton (*100% probable*), and perhaps before Etton Woodgate (*60.5% probable*). The outermost circuit at Northborough may be contemporary with the innermost circuit, although only a recut has been dated. *NZA-21960* is shown on Fig. 6.41 to emphasise that two circuits at Northborough are entirely undated; that the construction of the outermost circuit there is also undated; and that there are at least three uninvestigated enclosures within less than 10 km of Etton (Fig. 6.1). In these circumstances, it is dangerous to regard Etton as a founder monument.

The late fourth millennium date of the recut of F505/563 at Etton has implications for the original interpretation of F313, which cut it and was in turn cut by the Etton cursus. This was seen as replacing part of the western arc of the enclosure as its segments became progressively wetter, at a time when the segments of the eastern arc continued to be reworked in phase 1C, with slot-like recuts being made in the eastern arc (Pryor 1998, 106, fig. 115). Of the three samples which could be contemporary with F313, those for P3821 (OxA-14972, GrA-29355: Table 6.8) come from a layer overlying a slot-like 1C feature (layer 2 in section 227 of segment 12; Pryor 1998, 45, fig. 74:C); and that for *GrA-29353* comes from the upper of two layers attributed to phase 1C in a segment where the stratigraphy was particularly complex and subtle (layer 2 in section 205 of segment 10: the nearest published section being section 206; Pryor 1998, 19, fig. 73:B). Together these dates suggests that the use of the causewayed enclosure at Etton continued into the 33rd or 32nd century cal BC (*end Etton*; Fig. 6.33), that the Etton cursus is consequently one of the later examples of this class of monument, and that episodic activity at Etton continued into the early third millennium cal BC.

6.4.5 Implications for the Lower Welland valley

The middle and upper Welland valley, extending westward to between Market Harborough and Leicester, has so far seen less investigation than the Great Ouse and Nene valleys (Fig. 6.1). On the lower Welland (roughly speaking east of Stamford), the enclosures lie in an exceptionally rich archaeological setting. A salient feature of this is a monument complex encompassing Etton and Maxey and extending upstream at least to Barnack, for 9 km or more. Much of its potential area is still concealed by alluvium (Pryor *et al*. 1985, fig. 3). The enclosures may be the first monuments in the area, since most of the other known sites

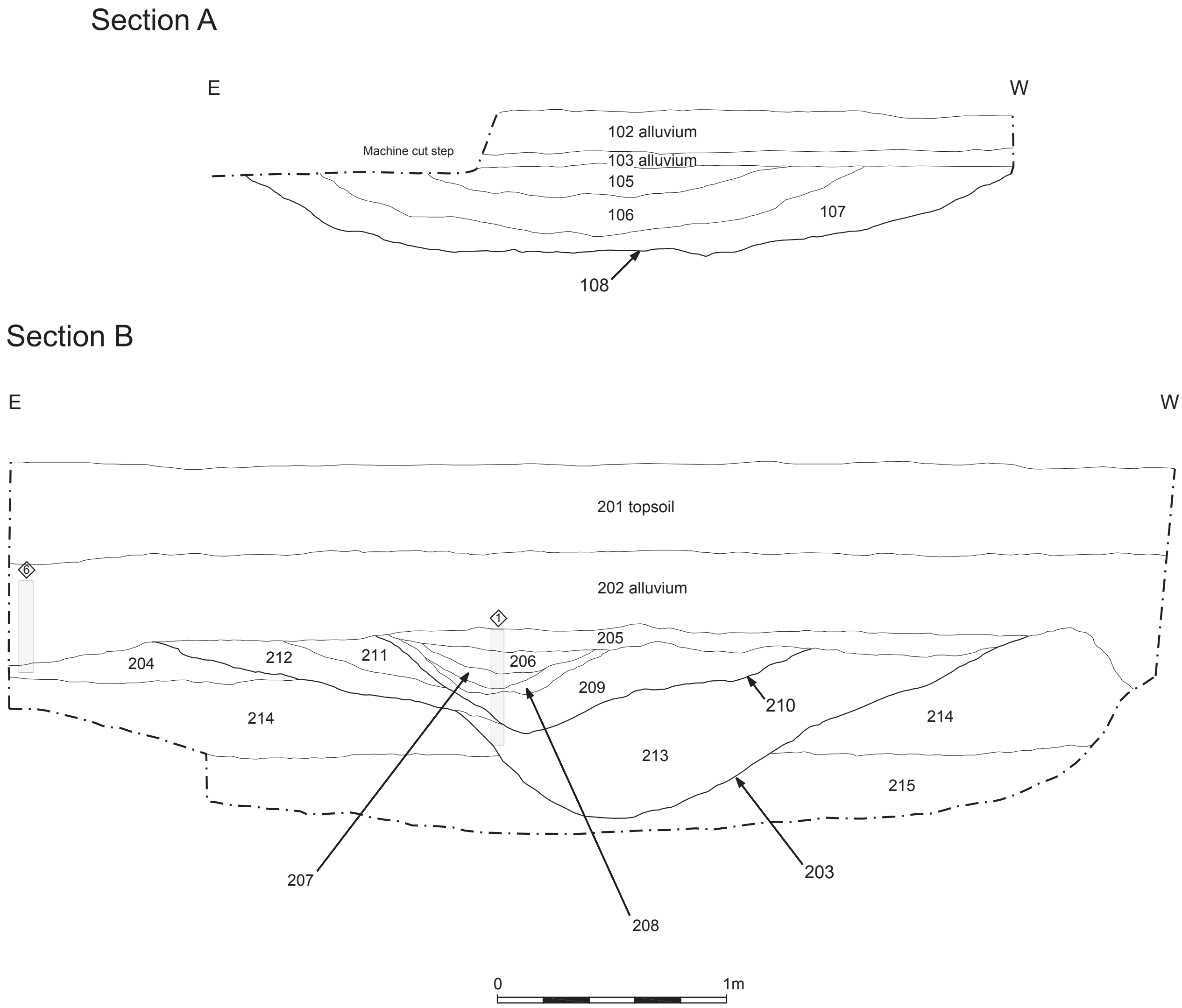


Fig. 6.38. Northborough. Sections of segments 108 and 210 of the innermost ditch. © Wessex Archaeology.

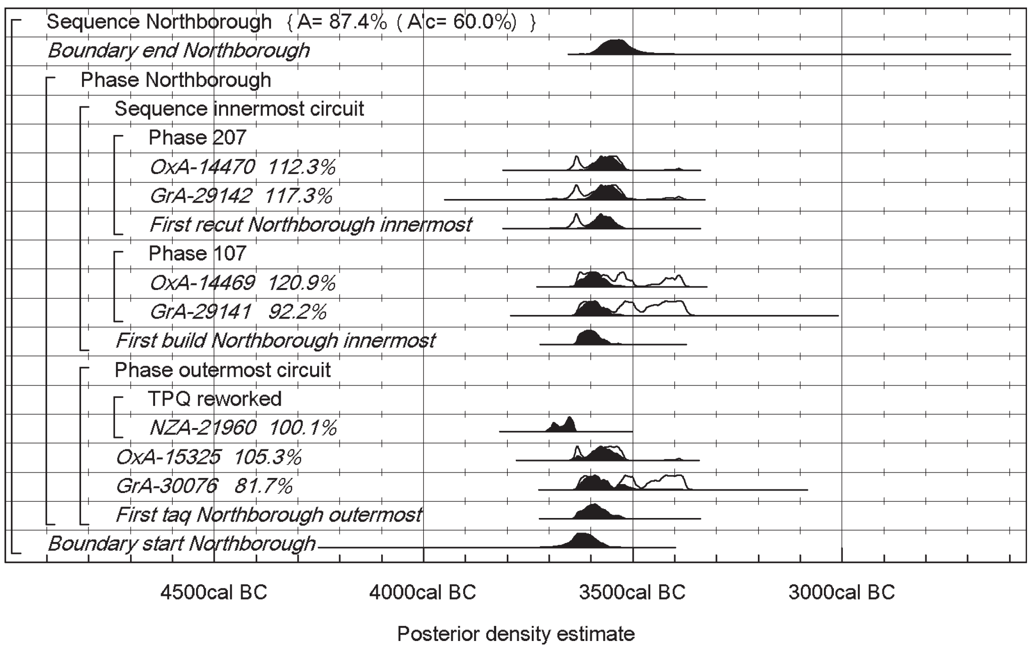


Fig. 6.39. Northborough. Probability distributions of dates. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

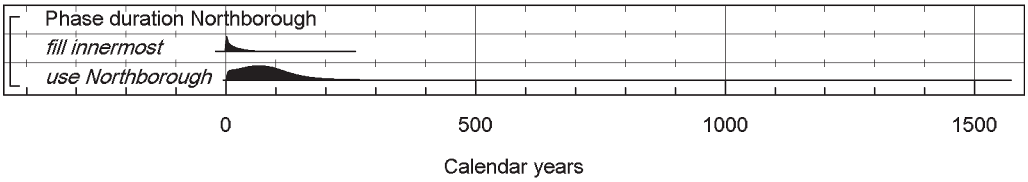


Fig. 6.40. Northborough. Number of years during which the enclosure was in primary use (use Northborough) and between the recut in the innermost ditch and its original construction (fill innermost), derived from the model defined in Fig. 6.39.

post-date them on stratigraphic or morphological grounds. There are some secure elements in the sequence. The Etton enclosure was cut by the Etton cursus after *3355–3165 cal BC* (*95% probability*; Fig. 6.33: *tpq F313*), probably after *3340–3260 cal BC* (*68% probability*). The Maxey cursus was stratigraphically earlier than the outer ditch of the Maxey henge and the much smaller inner ditch and central mound, and also earlier than one pit of pit circle IIIa, one of two which lay within the henge (Pryor 1985b, 59; W. Simpson 1985, 249). A cursus-like cropmark at Barnack, measuring *c.* 115 m by 20 m (Pryor *et al*. 1985, fig. 179), contrasts with dimensions of at least 2 km by 58 m and 1 km by 70 m for the Maxey and Etton monuments respectively.

These and the monuments which followed them are, unlike the causewayed enclosures, consistently poor in finds, especially from primary contexts. Indeed, where artefacts occur at all, they are often so few and abraded that they may have been redeposited. The Etton cursus seems to have been built in the very late fourth or early third millennium cal BC on the evidence of the *terminus post quem* cited above. The Maxey cursus may have been equally late, since there was Beaker pottery in its lower secondary fills west of the Etton enclosure (Pryor 1998, 110; 1985c, 301). If so, then the Maxey henge and pit circle IIIa would have been built in the third millennium cal BC.

One undated element at Maxey is a small palisaded enclosure 15.5 m by 10.5 m, subsequently burnt and covered by a small oval barrow which overlay an articulated male inhumation (Pryor *et al*. 1985, 62–5). It lay between the two cursus ditches and near the centre of the single entrance of the henge (Pryor *et al*. 1985, fig. 40). Its orientation, at variance with the cursus but shared with the slightly ovoid henge on the centre of which it was aligned, suggests that henge and barrow were contemporary (Pryor *et al*. 1985, 234). It remains possible, however, that the henge was built around the barrow.

The complex is characterised by a high frequency of small henge monuments. Four, if not five, have been excavated at Maxey (W. Simpson 1981; 1985; Powell 1977), where a cropmark suggests a further example (W. Simpson 1981, fig. 2: G). Of these, at least pit circle IIIa, which cut the Maxey cursus when only its primary silt had accumulated, is likely to date from the third millennium cal BC. A first millennium cal BC radiocarbon date measured on 'most of the animal bones' from the south half of the inner ditch of site 69, to the south of the henge (Table 6.11: UB-456), almost certainly reflects the presence in the bulk sample of bone which post-dated the monument, especially as there were late Bronze Age features in the immediate area (W. Simpson 1981, 38–42). Dates in the first millennium AD for oak charcoal samples from pit circles IIIa and IIIb within the henge (Table 6.11: Gak-657, -658) were viewed as 'inconsistent with the archaeological evidence', with GaK-658 possibly attributable to contamination from an overlying medieval plough furrow (W. Simpson 1985, 251).

Three small henges have been excavated in the Etton area (French and Pryor 2005, 23–42), and cropmarks suggest at least two more (French 2005, 169). Two of the excavated examples were multi-phase, and features belonging to the last phase of the more complex one, Etton Landscape site 2, yielded substantial parts of two Ebbsfleet Ware pots (Gdaniec 2005, fig. 43: 1, 2). Since Ebbsfleet Ware is locally rare except in the upper fills of the Etton enclosure (Kinnes 1998, 212), this suggests that the third and final phase of the Etton Landscape site 2 monument related to the later use of the enclosure, modelled as ending in *3330–3095 cal BC* (*95% probability*; Fig. 6.33: *end Etton*), probably in *3310–3210 cal BC* (*68% probability*). It is impossible to tell how long before this the first phase was built. The slight, successive ditches and pit circles of the monument could have followed each other quickly, especially as most of them seem to have been backfilled (French and Pryor 2005, 23–30, figs 16–18).

The numerous pits recently discovered to the south and west of the Etton enclosure, briefly mentioned above, echo the pits encountered by Wyman Abbott in the gravel pits area at Fengate, in their numbers, their density and the predominance in them of Peterborough Ware and Beaker. Most must either overlap with the later use of the enclosure or post-date it.

The clearance which had preceded the construction of the Etton enclosure was widespread in the area by the time the subsequent monuments in the complex were built (French 2005, 163–5). This provides a contrast to the limestone uplands further upstream to the west, where wooded conditions prevailed in the fourth millennium (Scaife 2005). By the later use of the enclosure, Etton underwent seasonal high water tables and flooding. The stream channel between it and Etton Woodgate began to encroach on the north-west part of the enclosure ditch, the clays and silts then deposited probably deriving from soil erosion on Maxey island immediately to the north-west. The small henges to the north of the enclosure were built on the then edge of the floodplain, after some alluviation had

Table 6.11. Radiocarbon dates from the Welland valley.

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)
Site 69, OS field 124, Maxey, Cambridgeshire						
UB-456		Collagen fraction of animal bones	South half of inner ditch of henge I, a slight penannular ditch 9.20 m in diameter, containing a cattle skull and a red deer rib with incised decoration coloured with ochre. There were similarly decorated red deer antlers in the surrounding discontinuous ditch and in a penannular ditch (W. Simpson 1981, 38–47)	2625±275	−23.1	1440–50
Pit circle IIIa, Bardyke Field, Maxey, Cambridgeshire						
GaK-657		*Quercus* sp. charcoal	Pit 9. One of 10 pits forming a circle 10 m in diameter, apparently backfilled soon after excavation and recut, containing animal bone and abundant charcoal. Two sherds possibly of Neolithic Bowl from other pits in circle (W. Simpson 1985, 251–64, figs 170, 174)	1730±90		AD 70–540
Pit circle IIIb, Bardyke Field, Maxey, Cambridgeshire						
GaK-658		*Quercus* sp. charcoal	Pit 3. One of 10 pits forming a circle 15 m in diameter, apparently backfilled soon after excavation, possibly recut, possibly a socket for two posts. Another pit of this circle cut the cursus ditch, others contained three possibly Neolithic body sherds (W. Simpson 1985, 251–64, figs 170, 175)	1640±90		AD 210–610

already taken place, and it was at this stage that monument building began on the slightly higher, better drained terrain of Maxey island, linked to the earlier enclosure by the Maxey cursus. Off the island, the lower-lying parts of the complex would have been surrounded by swelling and shifting water courses and, seasonally, by expanses of standing water (French 2005, 163–5).

6.5 East of the Fens

In strong contrast to west of the Fens, the few causewayed enclosures to the east are so far uninvestigated (Fig. 6.1). Two of the Suffolk examples stand out by their size. The larger of the two Fornham All Saints enclosures and another at Freston, on the Shotley peninsula between the Stour and Orwell near their joint estuary, both exceed 8 ha (Oswald *et al*. 2001, figs 3.14, 4.25), thus falling in the same size range as Haddenham. Freston is linked by the river Stour to a much smaller enclosure at Kedington, 70 km upstream. The significance of the Stour valley is highlighted by at least five uninvestigated elongated enclosures on the Essex side (D. Buckley *et al*. 1988, 86–90). Three of these clustered at Lawford, where an early Neolithic presence is reflected by small quantities of plain Bowl pottery and by leaf-shaped arrowheads in the assemblage from a Grooved Ware-associated monument some 2 km to the south (S. Shennan *et al*. 1985, 165, 174–5, 189). On the Suffolk side of the Stour valley, six elongated enclosures extend between Freston and Kedington (E. Martin 1989, 37). One of these lies within the same monument complex as the Stratford St Mary cursus (E. Martin 1981, fig. 33), where there is a possible small henge at the south-east terminal of the larger monument (E. Martin 1982). Twelve kilometres upstream from Stratford St Mary is a further cursus monument at Bures St Mary. Both are less than 300 m long, on a far smaller scale than the 1.9 km of the main cursus at Fornham All Saints.

North of the Stour, elongated enclosures remain concentrated along rivers flowing into the North Sea (E. Martin 1989, 37; Ashwin 1996, fig. 3), as they are along the Blackwater and its tributaries farther south in Essex (Chapter 7; D. Buckley *et al*. 1988, fig. 88). An excavated example at Yarmouth Road Quarry, Broome, in the Waveney valley in Norfolk (Robertson 2003), was oval in plan and measured 48 m by 18.2 m, with one lateral and one terminal entrance. The ditch was 0.5 to 1.9 m wide and only 0.2 to 0.5 m deep, its single fill providing no hint of the location of any original earthwork. It contained small quantities of struck flint and body sherds of plain Bowl pottery.

Two comparable cropmarks lie close to a probable causewayed enclosure at Roughton, in north-east Norfolk (Oswald *et al*. 2001, fig. 6.7). The original forms of these elongated enclosure monuments are problematic. The slightness of the ditch of the Broome example makes it highly unlikely that there was a central mound, and this impression is reinforced by descriptions and a sketch made of an oval example measuring *c*. 60 m by 25 m on

Weasenham Lyngs, West Norfolk, before it was ploughed flat during World War II. Here, three separate observers recorded a slight bank outside a surrounding ditch, the area within which was occupied by a flat platform some 0.50 m above the surrounding ground surface and edged by a slightly higher 'rim'. Two opposed entrances near one end may have been formed subsequently, since the ditch appears continuous in air photographs. Limited sectioning of the ditch showed it to be only 2.20 to 2.40 m wide and 0.30 to 0.50 m deep, with a shallow, bowl-shaped profile. Two sherds from the surface of the ditch fill are probably of Mildenhall Ware and, if they came to rest there from the interior when the earthwork was levelled, may suggest an earlier Neolithic date for this monument as well as for the Broome one (Petersen and Healy 1986, 72, 78–81, 96–7, pls XVII, XVIIII).

The only probable cursus monument in Norfolk is a cropmark measuring 55 m wide and up to 380 m long at Hanworth, 1.5 km north-west of the Roughton enclosure (Albone *et al*. 2004). Uninvestigated small henge-like monuments cluster around the south-east end of the Stratford St Mary cursus monument. Others are scattered, like possible examples beneath a barrow at Caistor St Edmund, south of Norwich (Ashwin and Bates 2000, 133–4), at Salthouse in north Norfolk and at Great Witchingham in mid-Norfolk (Edwards 1978, 92–3, fig. 46, pl. XXV).

Two ring ditches or round mounds thought of as Neolithic are only dubiously so. The first phase of Swale's Tumulus at Worlington in the Suffolk Breckland yielded large quantities of Mildenhall Ware and early Neolithic lithics and has been thought of as a small Neolithic round mound covering a cremation deposit which was later incorporated in a larger Early Bronze Age barrow (Briscoe 1956; Kinnes 1979a, 58–9). The original account, however, would be equally compatible with the raising of an Early Bronze Age barrow on the site of a Neolithic settlement (E. Martin 1981, 69), incorporating settlement material into the core of the mound, and preserving 'two small fires containing numerous Neolithic sherds . . . on old ground level' (Briscoe 1956). In this case the insertion of a cremation deposit accompanied by an Early Bronze Age vessel next to a large burnt 'Neolithic' area including burnt bone (Briscoe 1956, 104, fig. 1) would cease to be fortuitous. The cremation deposit, which was still so hot as to redden the sides of the pit in which it was buried (Briscoe 1956, 106), would have been interred next to its pyre site, and an adjacent 'Neolithic' grave, lined with charred wooden planking and containing some cremated bone (Briscoe 1956, 104), would accord with Early Bronze Age practice.

At West Stow, also in the Suffolk Breckland, a small, shallow ring ditch with a maximum dimension of less than 12 m surrounded a grave containing a crouched inhumation accompanied by a simple stone bead. In different parts of the upper fill of the pit were two Levallois-like cores, flint waste, and an unurned cremation deposit. Over 40 further unurned and unaccompanied cremation deposits, compact as if buried in containers, had been inserted into the ditch fills and the inner lip of the ditch in the south, east and north of its circuit (West 1990, fig. 6). Lithics from the ditch included two further Levallois-like cores, a fragmentary fabricator, an oblique arrowhead, and perhaps a chisel arrowhead (West 1990, 8–9). The monument has been thought of as Neolithic, because of these finds and because it lies in a concentration of later Neolithic lithics (West 1990, fig. 44). If this is the case, the secondary cremations might be seen as comparable with those in henge monuments, such as those at Dorchester-on-Thames, Oxon (Whittle *et al*. 1992). It is possible, however, that the ring ditch and burials are of Bronze Age date and that the lithics came from a pre-existing scatter, especially as the location coincides with the maximum concentration on the site of lithics of all periods (West 1990, fig. 5), and as two of the cremation deposits included bones stained green, as if by copper alloy (West 1990, 9).

A distinctive feature of the early Neolithic archaeology of East Anglia east of the Fens is the frequency of pits, which often occur singly or in small numbers and occasionally in larger groupings. The artefacts and food remains placed in them can be seen, even where excavation is extensive, as parts, even samples, of otherwise vanished assemblages derived from other contexts, such as middens rich in burnt material. It is common to find some of the sherds from a pot or some of the elements of a reduction sequence, but scarcely ever the whole pot or the whole sequence. Differential exposure to processes such as weathering or burning can sometimes be observed between refitting sherds of the same pot (Garrow 2006). The most extensively excavated larger groupings are at Hurst Fen (J.G.D. Clark 1960) and Sutton Hoo (Longworth and Kinnes 1980; Hummler 2005), both in Suffolk, and Broome Heath (Wainwright 1972), Eaton Heath (Wainwright 1973), Kilverstone (Garrow *et al*. 2005; 2006), Spong Hill (Healy 1988) and East Rudham (Doyle *et al.* 2005), all in Norfolk. They are typically made up of smaller clusters of features, each of which may represent a single episode of activity. This is most effectively demonstrated at Kilverstone, where the excavated areas included 236 pits in 28 clusters. The Kilverstone pits were dug and backfilled almost immediately, and those within each cluster were linked by conjoins between sherds of the same pots and had, on the evidence of the refitting sequences of the contained lithics, been dug and filled sequentially (Garrow *et al*. 2005; 2006). At Spong Hill, the Mildenhall Ware from individual clusters was distinct in form and decoration (Healy 1988, figs 55–60).

None of these sites has been well dated. For Kilverstone at least, there are measurements on charred hazelnut shell from eight pits in seven clusters in three excavated areas (Fig. 6.42), and another from a later feature (Table 6.12: Beta-178140). The eight measurements from the clusters are not statistically consistent (T'=14.2; $T'(5\%)$=14.1; ν=7), but become so if Beta-178147 is excluded (T'=6.3; $T'(5\%)$=12.6; ν=6). Beta-178147 is from a pit (Garrow *et al*. 2006, fig. 2.3: F40) which lacks diagnostic finds and is not linked into a chain of conjoins (Garrow *et al*. 2006,

Table 6.12. Radiocarbon dates from east of the Fenland basin. Posterior density estimates derive from the model defined in Fig. 6.42.

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	δ^{13}C (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
Broome Heath, Norfolk							
BM-679	D4	Bulk sample of *Quercus* sp. charcoal	Cutting LIV, L5. Base of fossil brownearth soil, containing plain Bowl sherds and struck flint beneath inner bank of bivallate C-plan enclosure. Pollen reflects relatively wooded environment (Wainwright 1972, 8–11; Dimbleby and Evans 1972)	5424±117		4500–3970	
BM-755	LI4	Bulk sample of unidentified charcoal, 'not comminuted'	Cutting M, L4. Surface of fossil brownearth soil, containing plain Bowl sherds and struck flint, beneath inner bank of bivallate C-plan enclosure. Pollen reflects acid grassland, probably pasture, in scrub (Wainwright 1972, 11; Dimbleby and Evans 1972)	4167±78		2910–2480	
BM-756		Bulk sample of *Quercus* sp. charcoal	Pit 29, layer 4. Pit 2.70 m across and 1 m deep. From deposit seen as thrown on to base of square timber container in W side; E side of pit backfilled around wooden post; W side twice recut. L4 contained large quantities of lithics and plain Bowl pottery, including a shouldered pot with a thickened neck and others with simple out-turned rims (Wainwright 1972, 18, 92, fig. 15, fig. 21: P178–P184; fig. 42: F57–9)	4523±67		3500–3010	*3500–3445* (*5%*) or *3380–3080* (*90%*)
BM-757		Bulk sample of *Quercus* sp. charcoal	Pit 40, layer 6. Pit 2.60 m across and 1.33 m deep. From black, ashy deposit covering floor and lower sides, which contained an exceptionally large assemblage of lithics and plain Bowl pottery, including fragments of 79 pots, most of them unshouldered and with out-turned rims (Wainwright 1972, 92, fig. 16, figs 27–31: P271–83, P293–330, figs 38, 43: F7, FP; fig. 42: F57–9)	4579±65		3520–3090	*3520–3100*
Eaton Heath, Norfolk							
BM-770		Bulk sample of *Corylus avellana* and *Betula* sp. charcoal	Pits 80, 81, 118. Cluster of three shallow pits containing Mildenhall Ware (Wainwright 1973, 7–9)	5095±49		3990–3770	
BM-771		Bulk sample of *Quercus* sp. charcoal	Collected from 4.50 m to 5 m in fill of shaft 108, which contained lithics and plain Bowl pottery (Wainwright 1973, 17–19, 32–3)	6256±59		5360–5350	
BM-772		Bulk sample of *Quercus* sp. charcoal	Base (at 5 m) of shaft 97A which contained lithics and plain Bowl pottery (Wainwright 1973, 12–13, 21–2, 31)	4444±103		3500–2880	
BM-773		Bulk sample of *Quercus* sp. charcoal	Collected from 1.50 m to 3 m in fill of shaft 97A which contained lithics and plain Bowl pottery (Wainwright 1973, 12–13, 21–2, 31)	3981±55		2830–2300	
BM-774		Bulk sample of *Quercus* sp. charcoal	Collected from 0 to 1.50 m in fill of shaft 97A which contained lithics and plain Bowl pottery (Wainwright 1973, 12–13, 21–2, 31)	4903±56		3800–3530	
Kilverstone, Norfolk							
Beta-178139		Charred hazelnut shell fragments	Area A, cluster T, pit 1410, context 4515. Single fill of feature containing 33 sherds/109 g Mildenhall Ware, 212 pieces struck flint, 1145 g burnt flint, 13 g charred hazelnut shells (Garrow *et al.* 2005; 2006)	4770±50	−25.0	3650–3370	*3645–3495*

Laboratory Number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**δ^{13}C (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Beta-178141		Charred hazelnut shell fragments	Area A, cluster AA, pit 1452, context 4602. Single fill of feature containing 23 sherds/172 g Mildenhall Ware, 166 pieces struck flint, 552 g burnt flint, 24 g charred hazelnut shells (Garrow *et al.* 2005; 2006)	4710±60	−25.0	3640–3360	*3640–3480* (*89%*) or *3475–3410* (*6%*)
Beta-178142		Charred hazelnut shell fragments	Area A, cluster W, pit 1472, context 4643. Single fill of feature containing Mildenhall Ware, struck flint, burnt flint, charred hazelnut shells (Garrow *et al.* 2005; 2006)	4670±70	−25.0	3640–3190	*3640–3420*
Beta-178144		Charred hazelnut shell fragment	Area C, cluster CC, pit 328, context 4097. Primary context in feature containing 18 sherds/75 g Mildenhall Ware, 264 pieces struck flint, 950 g burnt flint, 16 g charred hazelnut shells (Garrow *et al.* 2005; 2006)	4770±40	−25.0	3650–3370	*3640–3510*
Beta-178145		Charred hazelnut shell fragments	Area E, cluster Q, pit 19, context 37. Single fill of feature containing 8 sherds/119 g Mildenhall Ware, 795 pieces struck flint, 2491 g burnt flint, 57 g charred hazelnut shells (Garrow *et al.* 2005; 2006)	4850±50	−25.0	3710–3520	*3665–3515*
Beta-178147		Charred hazelnut shell fragments	Area E, cluster Q, pit 40, context 68. Single fill of feature containing 2 fragments/1g of indeterminate pottery, 1 piece of struck flint and charred hazelnut shells (Garrow *et al.* 2005; 2006)	4530±80	−25.0	3510–2920	
Beta-178148		Charred hazelnut shell fragments	Area E, cluster L, pit 42, context 100. Primary context in feature containing 15 sherds/116 g Mildenhall Ware, 23 pieces struck flint, 363 g burnt flint, 15 g charred hazelnut shells (Garrow *et al.* 2005; 2006)	4720±70	−25.0	3650–3350	*3640–3425*
Beta-178149		Charred hazelnut shell fragments	Area E, cluster D, pit 130, context 285. Primary context in feature containing 38 sherds/541 g Mildenhall Ware, 356 pieces struck flint, 1603 g burnt flint, unidentified charred cereal, 94 g charred hazelnuts (Garrow *et al.* 2005; 2006)	4800±70	−25.0	3710–3370	*3665–3490*
Beta-178140		Charred hazelnut shell fragment	Area A, pit 1433, context 4564. Single fill of pit containing 15 pieces of struck flint including a chisel arrowhead, 59 g burnt flint, <1 g charred hazelnut shell, close to a pit containing Peterborough Ware (Garrow *et al.* 2006, 84–9)	4510±40		3370–3020	*3360–3105*
Spong Hill, Norfolk							
HAR-7063		Charcoal (unidentified)	3408. SE quadrant of 3594, a contorted layer of burnt sand and gravel immediately below the topmost fill of 3367, a probably treehole containing burnt earth and a small Mesolithic assemblage including a scalene triangle and small, extensively worked points (Healy 1988, 25, 45, 104, figs 27, 40, 104)	8280±80	−24.6	7530–7070	
HAR-7025		Charcoal (unidentified)	3645. Fill of pit 3644, containing small sherd of Mildenhall Ware and Neolithic lithics. Sample apparently redeposited (Healy 1988, 18, 104, fig. 16)	8250±90	−26.2	7530–7050	
HAR-2903		Mature conifer (probably *Pinus* sp.) charcoal	1334. Hearth or oven of uncertain date, cutting Neolithic or later deposit (Healy 1988, 18, 104, figs 13–14)	8150±100	−29.4	7840–6820	

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
BM-1533		Charcoal (unidentified)	Feature group A, F9, F12, F17, F18, F20. Pits (F9, F12, F20) and natural features (F17, F18) in localised cluster, containing Mildenhall Ware and lithics (Healy 1988, 5–10)	4650±80	−25.0	3640–3100	*3640–3310* (*88%*) or *3235–3170* (*5%*) or *3160–3125* (*2%*)
BM-1534		Bulk sample of charred acorns and unidentified charcoal	Feature Group A, F3, F4, F7, F8, F16, F24, F32, F36, F49. Pits (F3, F4, F7, F8, F16, F24, F32) and natural features (F36, F49) containing Mildenhall Ware and lithics (Healy 1988, 5–10)	4950±120	−24.7	3980–3380	*3990–3510*
BM-1535		Charcoal (unidentified)	F118. Charcoal-rich layer containing featureless flint- and sand-tempered body sherds on base of pit or hollow. Some lithics from same feature (Healy 1988, 16–18)	4990±80 (4900 in text)	−24.1	3970–3630	*3995–3645*
Arminghall, Norfolk							
BM-129		*Quercus* sp. charcoal from centre of base of charred post *c.* 1 m in diameter	Posthole 7. One of a horseshoe-plan setting of 8 within the inner ditch of the henge (J.G.D. Clark 1936, pl. IV, fig. 3). Sherds of rusticated Beaker came from a 'charcoal seam' on the floor of the surrounding inner ditch (J.G.D. Clark 1936, 18–19)	4440±150		3630–2670	

table 2.5, figs 2.14, 2.48). It could thus, although within a cluster, have been of later date, especially as Beta-178147 is statistically consistent with Beta-178140, from a feature considered later than the clusters on artefactual and spatial grounds (Garrow *et al*. 2006, 84–9; T'=0.1; T'(5%)=3.8; ν=1). If Beta-178147 is excluded from the model, the remaining seven measurements indicate that the main use of the site fell between *3725–3525 cal BC* (*95% probability*; Fig. 6.42: *start Kilverstone*), probably *3660–3565 cal BC* (*68% probability*), and *3625–3320 cal BC* (*95% probability*; Fig. 6.42: *end Kilverstone*), probably *3590–3465 cal BC* (*68% probability*). The model estimates a span of use of *1–360 years* (*95% probability*; Fig. 6.43: *Kilverstone pits*), probably of *1–155 years* (*68% probability*). If both later dates are included, the use of the site falls between *3845–3540 cal BC* (*95% probability*; distribution not shown), probably *3725–3590 cal BC* (*68% probability*), and *3360–3020 cal BC* (*95% probability*), probably *3340–3180 cal BC* (*68% probability*). The dated pits, however, are less than 3% of those excavated, and there is clearly potential for more extensive dating here in the future.

From the other pit sites there are either no dates or rare dates on bulk charcoal samples. At Broome Heath, Ditchingham, two dates on bulk oak charcoal provide *termini post quos* for two of the 67 excavated pits (Fig. 6.42: *BM-756–7*). The samples for two further dates (Table 6.12: BM-679, -755) came from the base and surface of a soil profile preserved beneath a partly bivallate, palisaded C-plan earthwork, so that, as Andrew Herne pointed out (1988, 14), although both levels contained Neolithic artefacts, both the artefacts and the charcoal could have accumulated over extended periods. Despite this, BM-755 provides a *terminus post quem* of 2910–2480 cal BC (95% confidence; Table 6.12) for the inner and more substantial bank of the enclosure. This separates it in time from the pits, one of which underlay it (Wainwright 1972, 11). The earthwork, which was probably built in pasture (Dimbleby and Evans 1972), remains undated, despite the absence of post-Neolithic artefacts from beneath or within it (Wainwright 1972, 6–8).

At Eaton Heath, Norwich, one sample consisted of short-life charcoal bulked from three pits (Table 6.12: BM-770). Four further dates (Table 6.12: BM-771–4) from two of numerous shafts on the site, some of which contained Neolithic artefacts, probably derive from oak charcoal of various ages, collapsed with soil into features which were almost certainly solution pipes (Healy 1986, 57–8). The inconsistency of the last three with their depths in the shaft from which the samples came heightens this impression, and this site effectively remains undated. At Spong Hill, North Elmham, two samples from Neolithic contexts proved to be of Mesolithic date and must have been redeposited (Table 6.12: HAR-7025, -2903). Three dates on bulk charred plant remains, all of which included unidentified charcoal, provide *termini post quos* for Neolithic pits (Fig. 6.42: *BM-1533–5*).

Pits continued to be dug and filled in the region into the

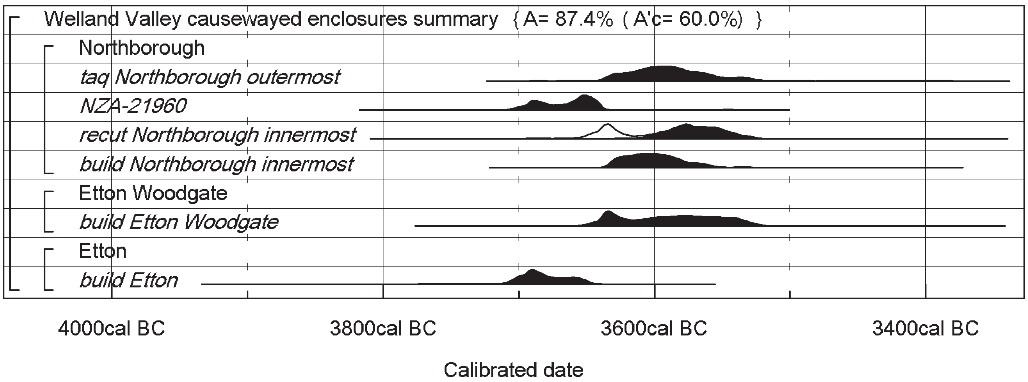


Fig. 6.41. Welland valley. Probability distributions for estimated dates of ditch cutting at Etton, Etton Woodgate and Northborough, derived from the models shown in Figs 6.33, 6.36 and 6.39.

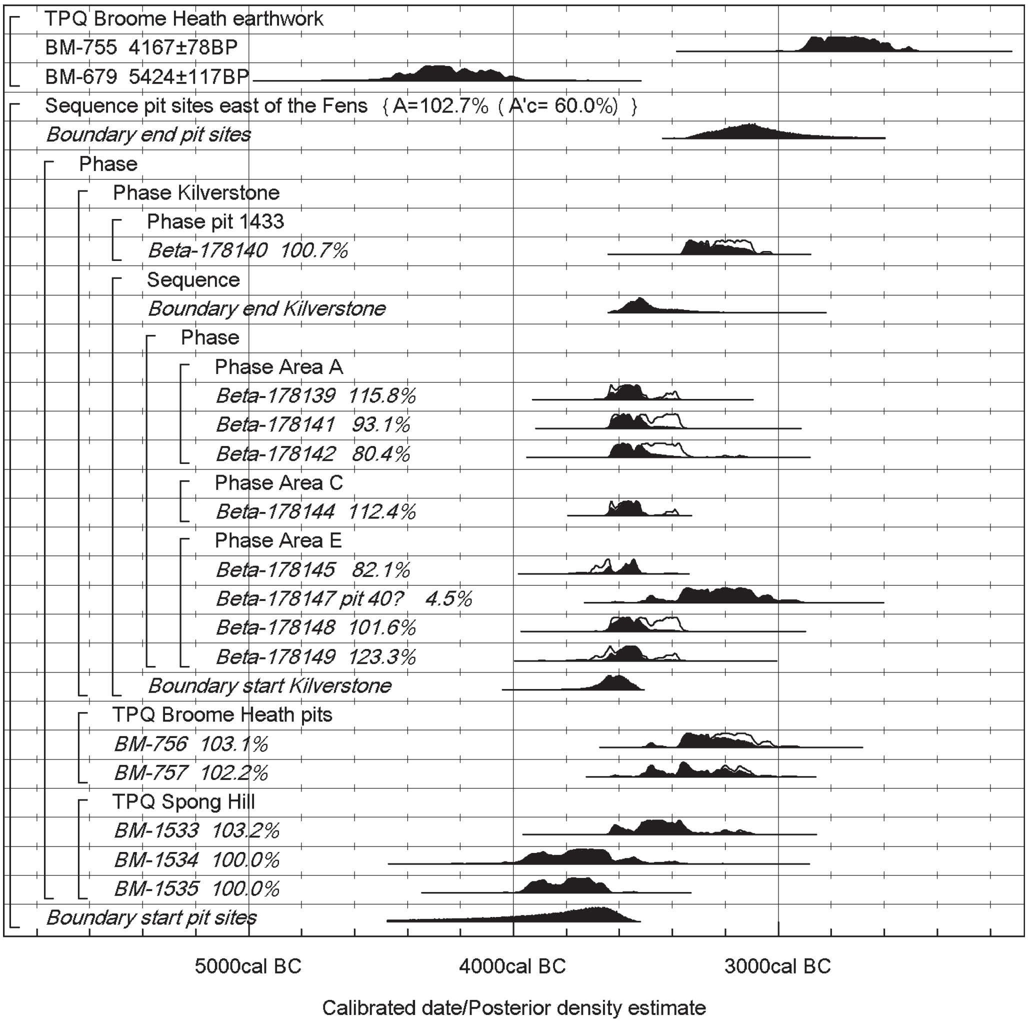


Fig. 6.42. Early Neolithic pit sites east of the Fens. Probability distributions of dates. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

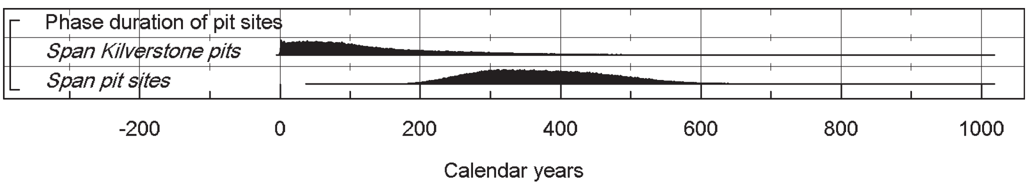


Fig. 6.43. Early Neolithic pit sites east of the Fens. Duration of use in years, derived from the model defined in Fig. 6.42.

second millennium cal BC. The character of their filling, however, changed, and extensive pit sites, made up of multiple clusters, became rarer (Garrow 2006, 149–53).

At two pit sites, different kinds of Bowl pottery occur in different kinds of context. At Eaton Heath, decorated Mildenhall Ware and related plain Bowl was found in the pit clusters, but only plain Bowl came from the shafts (Wainwright 1973, 24), suggesting that the more ornate fraction of the assemblage may have been buried preferentially in pits, and the less ornate either placed in already developing solution features or left on the surface to collapse into the shafts. On Spong Hill, decorated Mildenhall Ware and related plain Bowl were similarly found in pit clusters, while fragments of fine, hard, light-rimmed carinated vessels were confined to four scattered pits (Healy 1988, 18, 72, figs 52, 73–5). In fact, such vessels generally tend to occur in localised and inconspicuous contexts, such as a midden-like accumulation in a natural hollow in the Yare valley at the John Innes Centre, Colney (Whitmore 2004; S. Percival 2004) and a hollow or pit at Sparham in the Wensum valley (Healy 1984a, fig. 5.2). The same is often true of undifferentiated plain Bowl, as in a single pit at Brettenham, in the Thet valley (Healy 1984a, fig. 5.3), two widely spaced pits at Longham in mid-Norfolk (Ashwin 1998, 5–6; Wymer and Healy 1996, 36), a few scattered features at Three Score Road, Bowthorpe in the Yare valley (S. Percival 2002), a pit on Bunkers Hill, Witton (Wymer 1986) or among material fallen into a probably natural shaft at Brampton (Healy 1983), the last two both in north-east Norfolk. The pit clusters on more extensive sites, however, have almost always contained Mildenhall Ware, as at Kilverstone, Hurst Fen, Spong Hill, Sutton Hoo, Eaton Heath and East Rudham. There is more than a hint here of the differential deposition of the two traditions noted above at Barleycroft and Over in the Great Ouse valley.

The exception to this pattern is the extensive pit site on Broome Heath, where the large assemblage of over 400 pots is virtually undecorated. Although it was published as Grimston Ware (Wainwright 1972, 73), it is, as Herne has pointed out (1988, 14–15), dominated by neutral rather than open forms, many of them unshouldered; where shoulders are present they tend to be ledge-like rather than true carinations; and many of the rims are quite heavy (Wainwright 1972, figs 15–34). Some features, such as fluting inside a few rims (e.g. Wainwright 1972, fig. 20: P140; fig. 34: P408) and a few profiles (e.g. Wainwright 1972, fig. 32: P368, P369) could be replicated in typologically early assemblages, but most of the pots, including those from the two pits which provided radiocarbon samples, are more easily seen as undifferentiated plain Bowl and are difficult to distinguish from the undecorated component of a Mildenhall assemblage.

Broome Heath is distinguished from other extensive pit sites in further respects. Its pits tend to be larger than those on other sites, and a minority had complex fills and were filled with exceptionally large dumps of cultural material (Garrow 2006, 36, fig. 4.9). It is also the site of what appears to be a Neolithic barrow (Wainwright 1972, 4–5, fig. 2, pl. I). The mound has faintly visible flanking ditches and is slightly higher at its north-east end. Two unusual features are a narrow, parallel-sided 'tail' 40 m long and no more than 0.50 m high extending from its lower, south-west end, and its small size. The mound itself is only *c.* 35 m long, and *c.* 15 m wide, smaller than any of the eastern English long barrows considered by Evans and Hodder (2006, fig. 3.73), and perhaps better described as an oval barrow. Rabbits have several times brought Neolithic pottery and lithics to its surface, the pottery including a single decorated rim and fragments of at least seven Bowls indistinguishable from the excavated assemblage (Healy 1984a, fig. 5.5: P34; 1984b, 76). If they came from the body of the mound, they suggest that its construction, like that of the C-plan earthwork, post-dated at least the start of pit-digging on the site and that this extended at least a further 150 m north-east of the excavated area. Such an extension of the pit site raises the possibility that it was continuous along the gravel ridge at the north-east end of which is the oval enclosure at Yarmouth Road, Broome, mentioned above. The seven pits in the area around the Yarmouth Road enclosure were far less dense than those on Broome Heath (Robertson 2003, figs 4–5) but the pottery from them was indistinguishable from the larger assemblage (S. Percival 2003). The pit site may have extended for at least 1.5 km along the ridge. If pits at Kilverstone were continuous, at varying densities, between the excavated areas there, the scale here would be comparable (Garrow *et al*. 2006, fig. 1.4).

The preferred interpretation of the excavators of Kilverstone, from the perspective that pit-digging related to the persistence of a place, includes the possibility that areas with the largest and most densely grouped clusters were occupied repeatedly and for longer periods and by more people than areas with scattered small clusters and isolated features (Garrow *et al*. 2006, 81). This can be extended to other extensive pit sites. It may be that, in an area where enclosures are few, these were also aggregation sites, and that those who marked the time they had spent at a place, by digging a large pit cluster to bury a fraction of what their activities there had generated, were themselves made up of more than one group. The ridge stretching from Broome Heath to Yarmouth Road was exceptional in that it was monumentalised by the construction of a small long barrow and an oval enclosure, in the first case possibly after pit-digging had started.

6.6 Eastern England as a whole

In eastern England, radiocarbon dates are available from five causewayed enclosures and the ditches of Etton Woodgate, though those do not necessarily form a complete circuit. The dating of none of these sites is entirely satisfactory. This is largely a product of poor collagen preservation in bones recovered from the floodplain gravels in the river valleys and of the small scale of some of the investigations. For this reason, our date estimates for the chronologies of the enclosures in eastern England are not as precise as those in some other regions in this project.

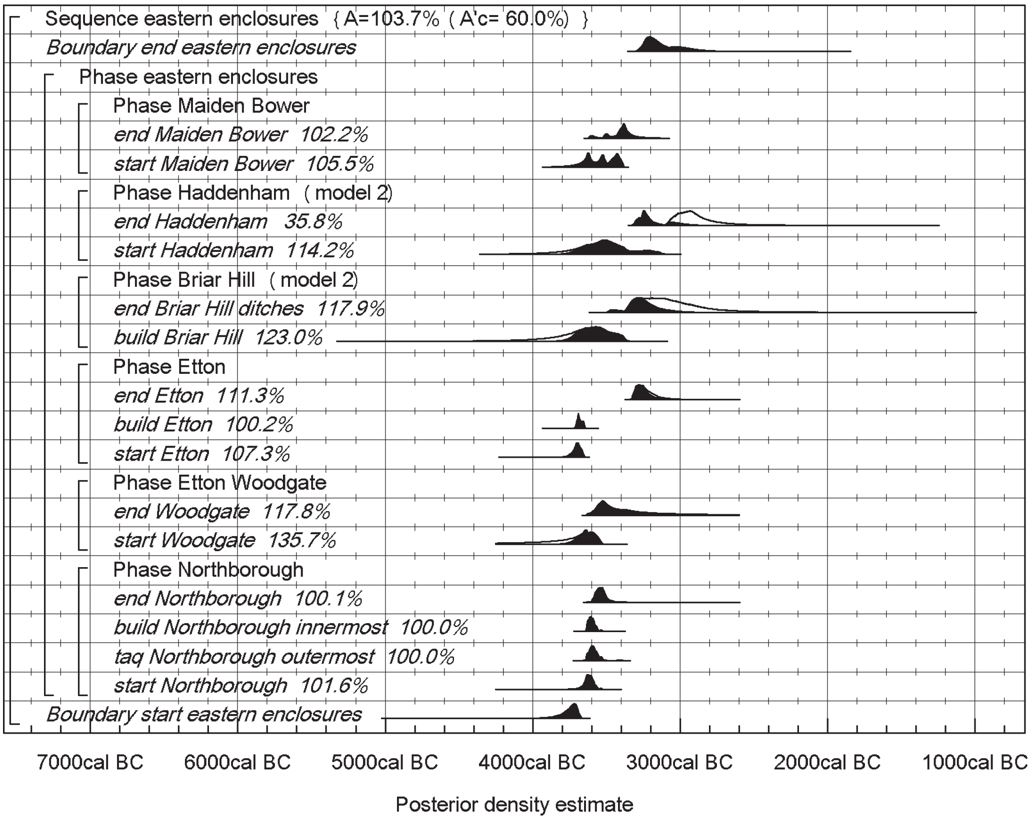


Fig. 6.44. Eastern England. Probability distributions of dates for the currency of causewayed enclosures, derived from the models shown in Fig. 6.4 (Maiden Bower), Fig. 6.11 (Haddenham, model 2), Fig. 6.23 (Briar Hill, model 2), Fig. 6.33 (Etton), Fig. 6.36 (Etton Woodgate) and Fig. 6.39 (Northborough). The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

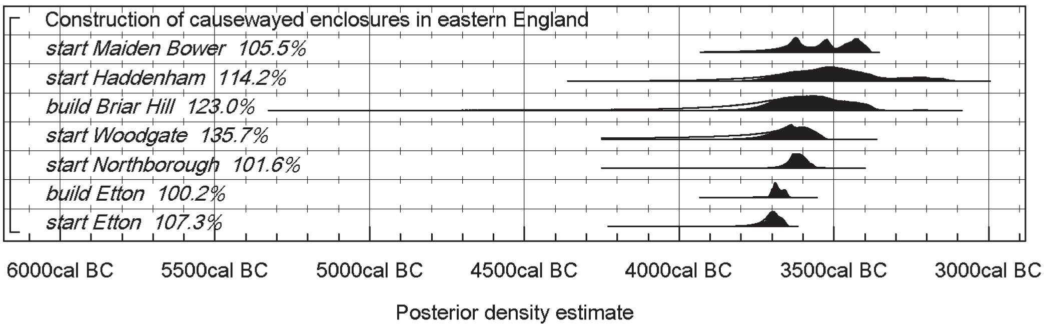


Fig. 6.45. Eastern England. Dates of construction of enclosures. Distributions are taken from the model shown in Fig. 6.44. The format is identical to that of Fig. 6.4.

Figure 6.44 shows the estimated dates when the enclosures in eastern England began, and when they went out of use. These posterior density estimates, derived from the models defined in Figs 6.4 (Maiden Bower), 6.11 (Haddenham, model 2), 6.23 (Briar Hill, model 2), Fig. 6.33 (Etton), Fig. 6.36 (Etton Woodgate) and Fig. 6.39 (Northborough), have been placed in an overall uniformly distributed phase, which represents the currency of use of causewayed enclosures in the region.

This model estimates that the first enclosure was constructed in *3900–3665 cal BC* (*95% probability*; Fig. 6.44: *start eastern enclosures*), probably in *3780–3685 cal BC* (*68% probability*). The primary use of the last enclosure ended in *3290–2860 cal BC* (*95%* probability; Fig. 6.44: *end eastern enclosures*), probably in *3265–3085 cal BC* (*64% probability*) or *3045–3015 cal BC* (*4% probability*).

Figure 6.45 provides a more detailed view of the initial construction dates of the six enclosures dated from this region. It is apparent that our estimates for the dates when Haddenham, Briar Hill and Maiden Bower were built are all imprecise, falling in the middle centuries of the fourth millennium cal BC. The dated examples among the cluster of enclosures in the lower Welland valley all appear to begin

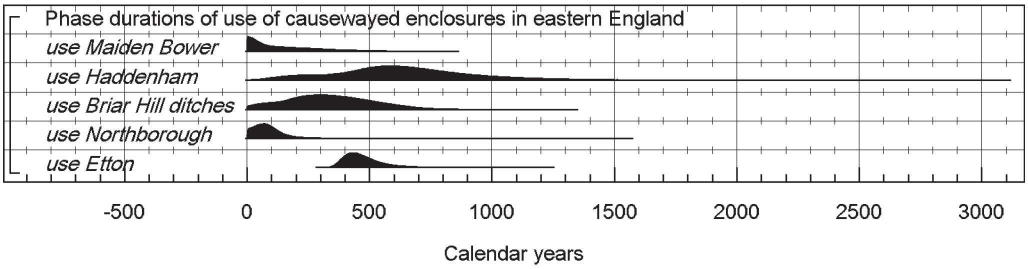


Fig. 6.46. Eastern England. Durations of primary use of enclosures, derived from the models shown in Fig. 6.4 (Maiden Bower), Fig. 6.11 (Haddenham, model 2), Fig. 6.23 (Briar Hill, model 2), Fig. 6.33 (Etton), Fig. 6.36 (Etton Woodgate) and Fig. 6.39 (Northborough).

in the 37th or 36th centuries cal BC. There is a reasonable probability, however, that Etton may pre-date 3700 cal BC (*38% probable, start Etton*; but only *9% probable, build Etton*), although this again may be an artefact of the inadequate number of radiocarbon dates available for the site. Despite the comparative uncertainty of the dating of the enclosures in eastern England, their construction appears to fall within the restricted period of the fourth millennium cal BC encountered in other regions in this project.

Figure 6.44 demonstrates that at least some of these enclosures continued in use into the later fourth millennium cal BC. This is most convincing at Etton, where primary use appears to have continued until *3330–3095 cal BC* (*95% probability*; Fig. 6.33: *end Etton*), probably until *3310–3210 cal BC* (*68% probability*). A number of comparatively late dates were obtained from residues on sherds in phase IC recuts of the ditch, and from roundwood in pit F505, which must pre-date the final reworking of the northern entrance. Briar Hill and Haddenham may also have continued in use in the late fourth millennium cal BC, although these sites are particularly poorly dated. At Briar Hill there is a group of comparatively late dates on short-life charcoal from late or final recuts of the inner ditch (Fig. 6.23). Again at Haddenham, there is another group of comparatively late dates (Fig. 6.11). Most convincing are the statistically consistent measurements on single fragments of short-life charcoal in context 1866 in segment J, an apparent recut. Although individually neither of these sites has entirely convincing late dating, collectively the evidence reinforces the impression that some of the sites in this region continued rather later than seems usual elsewhere.

Figure 6.46 shows the duration of the primary use of five of the enclosures from eastern England (Etton Woodgate has too few samples for an estimate of duration to be possible). They seem to have diverse histories. Etton was in use for *345–635 years* (*95% probability*; Fig. 6.34: *use Etton*), probably for *380–510 years* (*68% probability*). Briar Hill and Haddenham may also have been in use for considerable periods of time. Although based on limited programmes of dating, the sites at Maiden Bower and Northborough, in contrast, appear to have been in use for relatively short periods of time (especially in the innermost ditch of the latter), perhaps for under a century. Given the imprecision of their dating, even shorter histories cannot be ruled out.

While there are therefore many uncertainties for the enclosures of this region, important aspects of varied histories can be suggested. It is possible that all the dated enclosures were initiated in the 37th century cal BC (Fig. 6.45), although this cannot be demonstrated unequivocally from the available evidence, and it is possible that some of these sites began in the 36th or even the 35th century. Nonetheless, even within the 37th century, there are hints of a chronological sequence. Of the dated examples, Etton was probably constructed first (*78% probable*). There is also a good chance that the first circuit at Northborough was dug before 3600 cal BC (*73% probable*). Given the imprecision of the available chronologies, it is difficult to place the other dated enclosures within a series, other than to say that they were probably constructed after Etton. So, it is apparent that there is a sequence and some time depth in the construction of the enclosures dated in eastern England, although it remains a possibility that this time depth could have been encompassed by a single human lifespan in the 37th century cal BC. It is important not to confuse the uncertainty in some of our estimated chronologies for this region with duration of human practice. There was a point in time when the first antler pick broke the ground to build the Haddenham enclosure — the problem is that our estimate of the date of this event spans nearly a thousand years (*3960–3125 cal BC*; *95% probability*; Fig. 6.11: *start Haddenham*; *3725–3365 cal BC*; *68% probability*). This does not change the fact that initiating the enclosure was an event which happened in one particular year in real historical time.

Regardless of their precise sequence, no one enclosure is identical with any other. All may have started with the same general kind of assembly of people and commitment of their labour, but it is far from certain that these circumstances need have been uniform from site to site. Some may have been laid out in one act, while others could have come into being more gradually as pits were extended into segments, as at Briar Hill and in parts of Haddenham for example. It is not clear from the models currently available for these sites whether there is a temporal difference between the construction of the sites with single circuits and those with double or multiple circuits, or between the circuits of the latter. There are too few reliable dates from Briar Hill to allow the kind of chronological separation detectable in other regions, although there is a hint of difference at Northborough. In any case, the possible repetition of

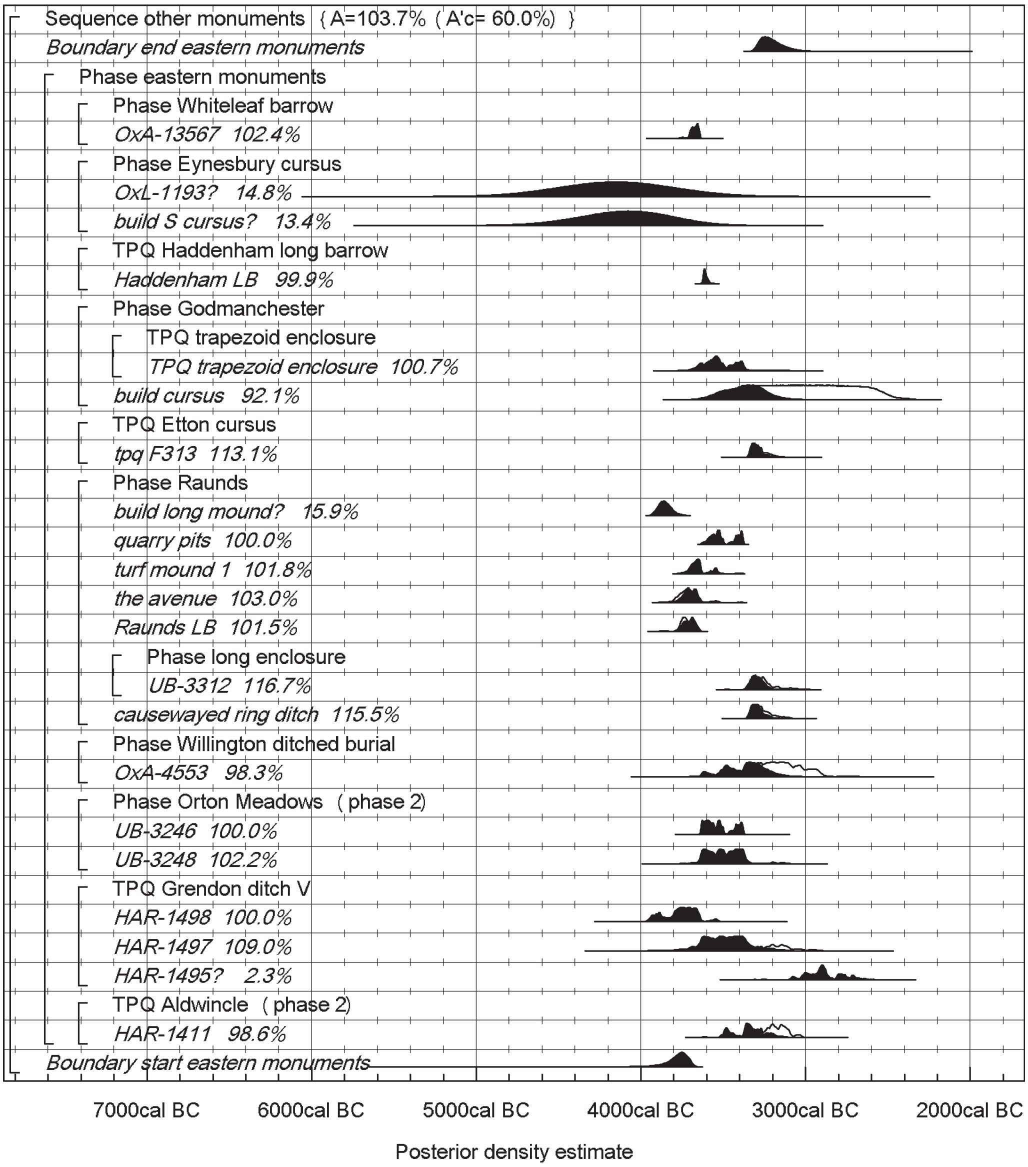


Fig. 6.47. Eastern England. Probability distributions of dates for the currency of other constructions, derived from the models shown in Fig. 6.6 (Whiteleaf), Fig. 6.13 (Eynesbury cursus), Fig. 6.16 (Haddenham long barrow), Fig. 6.15 (Godmanchester), Fig. 6.33 (Etton cursus) and Figs 6.25–7 (Raunds). The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

circuit construction may not have been any more important or impressive than the creation of single circuits, as emphasised by the scale of the Haddenham enclosure (Evans and Hodder 2006, chapter 5).

In the varying arenas thus created, there were diverse practices of deposition. The contrast is strongest between the extensively investigated and fully published examples of Etton and Haddenham (Pryor 1998; Evans and Hodder 2006). Although Haddenham is impressively large, and may according to our models have been long-lasting, including episodes of recutting, strikingly little material was deposited in the ditch segments at any stage of their history. Etton, by contrast, was much smaller, its ditch segments neither particularly wide nor deep, and its bank, where and when present, probably not especially eye-catching. The western arc was open to flooding and had hazel trees growing in the ditch segment bases (Pryor 1998, 21–9, 356–7). The eastern arc began to be backfilled soon after initial construction, after which it saw a succession of deposits, recuts and further backfilling (Pryor 1998, 357). Both cultivation and herding probably took place close by, if not within the enclosure, and the arena in a sense sedimented back into the landscape. Nonetheless, this – to our eyes – far from monumental setting became, perhaps from its beginning, a place to which people returned again and again over long periods of time, producing the sequences of deposition, backfilling and recutting that characterise the eastern arc. It is a moot point how much was deposited at any one moment in this long history. Diversity may again be the key, both between the two sides of the enclosure and within each side and its individual segments. Powerful depositions could have been created with rather little material, for

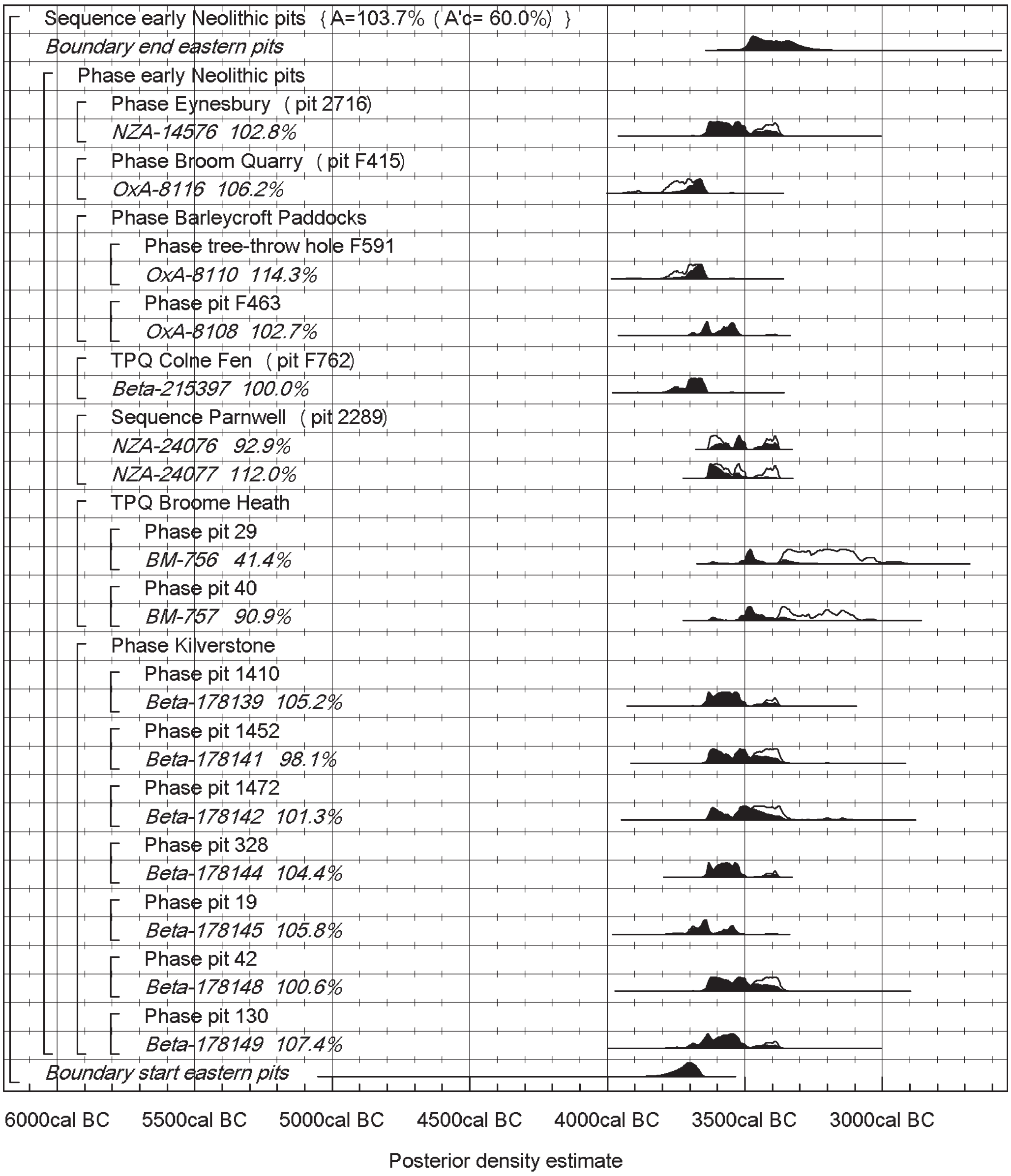


Fig. 6.48. Eastern England. Probability distributions of dates from early Neolithic pits. The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

example the 'groups of material or single prominent items' 'usually arranged in a linear pattern' in segments 6 and 7 of the east side (Pryor 1998, 357). Much of the renown of Haddenham, by contrast, might have been created by and in the circumstances of its construction, and something other than the urge to maintain a practice of abundant deposition brought people back to the site for a long time subsequently (though here we should note again that the excavators have argued on other grounds for comparatively short primary use: Evans and Hodder 2006, 329). The mobilisation of labour to create Northborough, finally, whether in one or more episodes, may also have been in its own way impressive, but on present evidence it appears not to have led to a long subsequent history for the site.

The possible relative brevity of Northborough, on the one hand, and the sequence demonstrated between the initiation of Etton and Etton Woodgate, on the other, offer ways of thinking about clusters of enclosures, especially that in the lower Welland and the adjacent part of the lower Nene. Both succession and overlap are indicated. In this context, it is striking that Etton was *not* enlarged, its character being maintained or enhanced by continuing deposition and localised remodellings. Haddenham likewise was not remodelled or subdivided (and we cannot say where in its sequence its palisade came), but in contrast no other known enclosure was built within some 20 km of it (setting aside the possible example at Landbeach). Perhaps this is in some way connected with the presence of two, possibly three, long barrows in its vicinity. We may need here to think beyond individual enclosures to differences between the histories of localities and local or wider communities, of which enclosures were only a part.

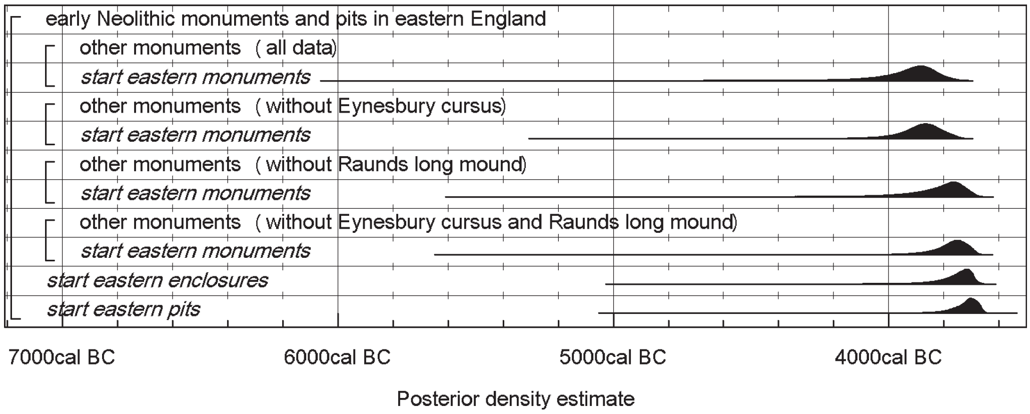


Fig. 6.49. Eastern England. Probability distribution of dates for the start of causewayed enclosures and other monuments. The format is identical to that of Fig. 6.4. The distributions are derived from the models shown in Figs 6.44 and 6.47 and from models of identical form to Fig. 6.47 which exclude the cursus monuments from Eynesbury, and both of these and the long mound at Raunds respectively (see text).

The settings of these eastern enclosures are a final dimension to consider. While the dated examples, with the obvious exception of Maiden Bower on the Chilterns, are all low-lying, their locations differ in detail, as illustrated by Oswald *et al*. (2001). They may all, however, have been set in open environments. Haddenham, Etton and Northborough all appear to have been built in cleared landscapes. The Mollusca from Great Wilbraham might suggest an absence of ancient woodland and the presence of both scrub or light woodland and open ground (J.G. Evans in C. Evans *et al*. 2006, 143). Briar Hill, which was built on the valley side geology favoured by flint scatters of all periods, may also plausibly be thought of as belonging to a more rather than less open environment, though we do not know that for certain. The causewayed enclosures of eastern England may thus differ from those of other areas in that they were built in already open and by implication occupied areas, rather than in woodland on the periphery of habitation as they were on the southern Chalk.

Turning to the character of existence in eastern England, it is striking how many sites and monuments on both sides of the Fens are confined to river valleys and the fen-edges (Mills 2006). The alignment of the Broome Heath pits, barrow and elongated enclosure along a river terrace echoes those, on a larger scale, of the enclosures and barrows along the terrace of the Great Ouse at Haddenham (Evans and Hodder 2006, figs 1.1–2), the Grendon and Raunds monuments along the Nene (Last 2005, 344–6, fig. 11; Harding and Healy 2007, fig. 1.4), or the alignment of monuments at Fengate, probably relating to a former inlet (Pryor 2001, 406–7). All could be seen to emphasise the importance of corridors, even of procession, through a largely wooded landscape, itself structured by the course of the river valleys. Such patterning in the use of and movement through the landscape may be seen to go back to the Mesolithic in the area, seen especially in some of the evidence from Raunds in the Nene valley, as set out above.

Jessica Mills (2006) sees these river valleys as busy places, foci of movement, settlement and monument building, where local dwellers mixed with more distant visitors and where the mundane was juxtaposed with the exotic. The river itself would have served not only as a routeway for long journeys but also as a metaphor for the corporate identity of the valley dwellers. She notes that the cluster of enclosures on the lower Welland and Nene, linked by their shared ovoid plans (Oswald *et al.* 2001, fig.6.3), coincides with a pronounced meander of the Nene which marks the shortest distance between the two rivers, at a point where the topography may have acted as a funnel encouraging movements between their valleys.

Against this broad sense of a general mode of living in the region, we can suggest further differences, in terms of varying kinds of constructions, distinctive emphases from valley to valley, and contrasts (as already partly explored above) between west and east of the Fens. First, it is possible to distinguish different monument-building traditions from an early stage. One gave rise to causewayed enclosures and long barrows, the familiar, ‘classic’ monuments of the early Neolithic, although the enclosures in this region were often poorer in cultural material than those in other regions (C. Evans *et al*. 2006, table 12). Another gave rise to rectilinear and elongated monuments even poorer in finds and sometimes devoid of them, like the trapezoidal enclosure at Godmanchester or the avenue at Raunds, in low-lying river valley sites in contrast to the mixed upland and river valley locations of the ‘classic’ monuments. Their forms, locations and sparseness of cultural material suggest that the beliefs and behaviour which they embodied may have been perpetuated in the construction of the far more numerous cursus monuments and elongated enclosures in the region. It may be significant that a cursus was *appended* to the Godmanchester trapezoid enclosure, extending its original alignment, while two others were built *cutting across* the Etton and Fornham All Saints causewayed enclosures, as if superseding them. A third tradition of small, diverse funerary monuments may be seen in the Whiteleaf barrow and the first, undated phases of sites

such as Orton Meadows and Aldwincle, or, indeed, the early phases (I and II, including the chamber and small ovoid mound) of the Haddenham long barrow (Evans and Hodder 2006, figs 3.74–5; and see above).

A fourth tradition may be seen in small, non-funerary ring ditches containing Neolithic Bowl pottery and contemporary lithics. One example is Dog Kennel Field, Elton, where the ring ditch had a single entrance in its first phase (French 1994, 20–23). Another is Eynesbury where, whether or not the pit which yielded the sample for NZA-14329 blocked an entrance in the ring ditch in question (see above), the ring ditch itself contained a similar assemblage to the Dog Kennel Field one, concentrated around a second entrance (Ellis 2004, 8–13, 25, 28–30). These sites, together with ring ditches at Brightlingsea, Essex, and Rainham, Greater London, which both yielded Mildenhall Ware (Chapter 7), could be seen as cognate to the unmounded first phases of some of the funerary monuments. They could also be seen as ancestral to small henge monuments like those which figure in the monument complexes of the region, notably clustering near the Maxey/ Etton and Fornham All Saints cursus monuments. The minimal dating evidence for the larger henge monuments of the region, in the form of *termini post quos* for Elton and the timber setting at Arminghall (HAR-3111; BM-129; Table 6.12) and rusticated Beaker sherds on the base of the inner ditch of the latter (if it was bottomed), places at least the two ditches, and possibly the timber setting as well, in the third millennium cal BC. This does not, however, preclude an earlier date for some of the smaller monuments. It is noteworthy that a few of them, notably at Etton and, beyond the region, Dorchester-on-Thames, contained Peterborough Ware (Gdaniec 2005; Whittle *et al*. 1992), in contrast to the Grooved Ware or Beaker more usual in larger henge monuments.

In terms of differences between valleys, we can note again the differential distributions of enclosures and other monuments. If we take the lower Nene together with the adjacent lower Welland, on the one hand, and the siting of Haddenham at the lowermost part of the Great Ouse before the Fens, on the other, there is a possible contrast with the upper parts of the valleys. The pair of enclosures on the upper Nene, Briar Hill and Dallington, is not matched in the upper Welland or the upper Great Ouse, although there are probable examples at Cardington on the middle course of the Great Ouse, and Husbands Bosworth, near Market Harborough, close to the headwaters of the Welland (Fig. 6.1), the latter evaluated by University of Leicester Archaeological Services (Butler *et al.* 2002). If existence was in various ways patterned in accordance with the course and flow of the valleys, did Haddenham and its locality in some fashion determine or dominate the nature of life in much of the rest of the Great Ouse valley? In other respects, the distribution of monument clusters at intervals down the length of both the Great Ouse and the Nene could suggest some similarity between these two valleys; not enough research has been carried out yet in the upper Welland for comparison of this kind.

We have already suggested a major difference in the early Neolithic between west and east of the Fens, in terms of the relative absence and presence of the practice of pit-digging and deposition in pits. Intensive pit-digging and monument building rarely coincide in the region, notable exceptions being Etton (Fig. 6.29) and St Osyth in Essex (Fig. 7.3). This occasional coincidence with enclosures may reinforce the case for large pit concentrations as places of aggregation in their own right. Relatively few pit concentrations have been found west of the Fens, and examples such as Barleycroft-Over and Etton could be classed as belonging to the zone where the rivers enter the fen basin rather than to the western river valleys proper; certainly Raunds has no concentration of early Neolithic pits. More pit concentrations have been found east of the Fens, though by no means, on present evidence, everywhere through East Anglia (Garrow 2006, fig. 3.7).

With regard to material, the users of the causewayed enclosures in the region not only deposited less in them than their counterparts elsewhere (although Great Wilbraham may be an exception to this generalisation: C. Evans *et al*. 2006, table 12), but deposited material reflecting rather different patterns of contact and exchange. Pottery came overwhelmingly from local sources (Bamford 1985, 104–7; Knight 2006c, 136; Kinnes 1998, 161), although diverse fabrics may sometimes suggest the convergence of several groups. Haddenham is an exception in that 18% of the small assemblage, confined to a single segment, was in a shelly fabric which must have been brought to the site (Gdaniec 2006, 299, 306). The single non-local pot at Briar Hill (Bamford 1985, 105) is more typical. Axeheads and other implements of non-local stone are mainly of group VI, from Cumbria. That source dominates at Briar Hill (Bamford 1985, table 15), occurs in roughly equal proportions to group VII (from north Wales) at Etton (Edmonds 1998), was present at Great Wilbraham (C. Evans *et al*. 2006, 133), and accounts for the only non-local axehead at Haddenham (Middleton 2006d, 296). The same group also predominates in other early Neolithic contexts. Small quantities have been found at Fengate, Hurst Fen, Parnwell and Kilverstone, as well as in the debatably dated oval monument at Eynesbury and the probably redeposited Neolithic assemblage from Swale's Tumulus. This is not surprising because group VI is the most abundant in the region overall, followed by south-western greenstones, grouped and ungrouped, which are almost as numerous (B. Green 1988, tables 17–18; Cummins and Moore 1988, table 19). No south-western greenstones, however, have been found in fourth millennium cal BC contexts in eastern England. It may be that, in the early to mid-fourth millennium cal BC, exotic stone implements, with their connotations of remote sources, chains of users, and past events (Edmonds 2006), tended to reach the region not from the south-west but from the north-west.

Flint axeheads, far more numerous than stone ones east of the fens, were sometimes also from non-local sources. In several assemblages there are whole or fragmentary axeheads of distinctive flints, clearly different from the local

raw material of which the bulk of each industry is made, for example at Etton (Middleton 1998, 234–5), Briar Hill (Bamford 1985, 60), Raunds (Ballin forthcoming), Hurst Fen (J. Clark 1960, 224–5) and Spong Hill (Healy 1988, 33). These are predominantly near-white or orange in colour, and must have come from secondary, probably till, sources, rather than from the Chalk. On the evidence of trace element analysis, axeheads were also brought into the region from the Sussex Chalk (Craddock *et al.* 1983; forthcoming). Although none has been found in an early Neolithic context, some may be of this period, since the Sussex flint mines began to be worked early in the fourth millennium cal BC (Chapter 5). Chalk flint was also transported over short distances as raw material for knapping, low proportions having been identified at Haddenham (Middleton 2006d, 282), Great Wilbraham (Evans *et al.* 2006, 131) and Raunds (Ballin forthcoming).

One argument for large pit concentrations as places of aggregation is the shared prevalence of Mildenhall Ware, deposited in all the enclosures discussed here, as well as in all but one of the large pit cluster sites, but less consistently in other kinds of context. Variation within the tradition can be considerable. The assemblage from the Etton enclosure stands out by the elaboration, diversity and frequency of its decoration (Kinnes 1998, figs 175–201), which contrasts markedly with the less frequent and more restrained decoration of the Briar Hill assemblage (Bamford 1985, figs 52–5), only some 60 km to the south-west. Given that the initial use of both enclosures seems to have lasted for several centuries (Figs 6.24 and 6.34), this indicates sustained, long-lived traditions, with the corollary that each was consistently used by a different population and probably had a different social catchment. There are furthermore sufficient differences between the Etton and Hurst Fen assemblages to prompt the identification of regional substyles (Pryor *et al*. 1998, 209–12). It is possible to suggest that each Mildenhall assemblage has its own peculiarities, whether in the form of spiral decoration on a vessel from Great Wilbraham (Knight 2006a, fig. 16:8), or columns of short horizontal lines on pots from two different clusters at Kilverstone (Garrow *et al*. 2006, fig. 2.16: P.101, fig. 2.23: P.53), or unpatterned impressed decoration on some of the coarser pots in two of the clusters on Spong Hill (Healy 1988, 71–2, figs 63–5, 71–2). In the pit cluster sites, both the distances between clusters and the dimensions and proportions of individual pits vary more between sites than within a single site (Garrow 2006, 34–5, 58–9, fig. 4.9). All this would be consistent with the repeated return to a single location of people with shared ideas about how certain things should be done. From this perspective, the distinctive characteristics of Broome Heath could reflect its use by a particular social group. It remains to be seen how brief the overall span of use of the Kilverstone pit clusters was. At St Osyth in Essex at least the use of the pits was probably confined to a generation (Chapter 7).

There is some hint of development in pottery styles. In the Haddenham long barrow, a light-rimmed, open, slightly carinated Bowl with fluting inside the rim was deposited in phase I and sherds of a Mildenhall Ware Bowl in phase III. However, frustratingly, as set out above, this relative order cannot be given estimates of date, other than to say that it is probable that both were deposited after *c.* 3600 cal BC. In the Orton Meadows monument three undecorated, light-rimmed, open, carinated Bowls were deposited in the first phase and two vessels with heavier rims and fluting on the rim tops and the interior of the necks in the second phase, for which there is a date of *3660–3335 cal BC* (*95% probability*; Fig. 6.28: *UB-3248*), probably *3635–3565 cal BC* (*20% probability*) or *3535–3490 cal BC* (*15% probability*) or *3470–3370 cal BC* (*33% probability*). Otherwise, stylistically early pottery is dated only by a single short-life sample at Barleycroft Paddocks (Fig. 6.13: OxA-8110) and by *termini post quos* at Peacock's Farm (Fig. 6.18: *Q-525/6*, *Q-527/8*, *CAR-790*). The Padholme Road pottery at Fengate is problematic. Although plain, open and light-rimmed, it has none of the carinated forms which constitute part of dated early assemblages like those from beneath the Ascott-under-Wychwood and Hazleton long barrows (Chapter 9), and it has affinities with the large assemblage from Broome Heath, for which there are relatively late *termini post quos* (Fig. 6.42: *BM-756–7*). The date in the second half of the fourth millennium cal BC provided by the corner post of the Padholme Road structure (Fig. 6.28: GaK-4197) would be consistent with such a similarity.

The currency of Mildenhall Ware is best defined by the estimates for the span of the eastern English enclosures (Fig. 6.44). The few measurements on short-life samples associated with the style in pits at Barleycroft Paddocks and Kilverstone (Figs. 6.13 and 6.42) fall within this span. At present, there is no conclusive indication for early Neolithic activity in this region before the use of enclosures, and thus the introduction of Mildenhall Ware, although there could have been a generation or two of Neolithic activity before enclosures began (Fig. 6.51). It should be noted that our date estimates for the introduction of enclosures and for the beginnings of Neolithic activity are completely independent. The dates included in the enclosures model are not used in the overall model for the early Neolithic in the region (to ensure that our sample is not overly biased towards material from the enclosures). Current evidence therefore gives little space for a pre-Mildenhall Ware phase in this region. We will return to these issues in Chapter 14.

A model for the chronology of other early Neolithic monuments and constructions in eastern England (excluding causewayed enclosures and Etton Woodgate) is shown in Fig. 6.47. The distributions for the construction dates of these monuments have been taken from the models defined in Figs 6.6 (Whiteleaf), 6.13 (Eynesbury), 6.15 (Godmanchester), 6.17 (Haddenham long barrow), 6.25–7 (Raunds) and 6.33 (Etton cursus). This model excludes the surprisingly early date estimates for the two cursus monuments at Eynesbury and for the insecurely dated long mound at Raunds.

The problems relating to the dating of both the Eynesbury

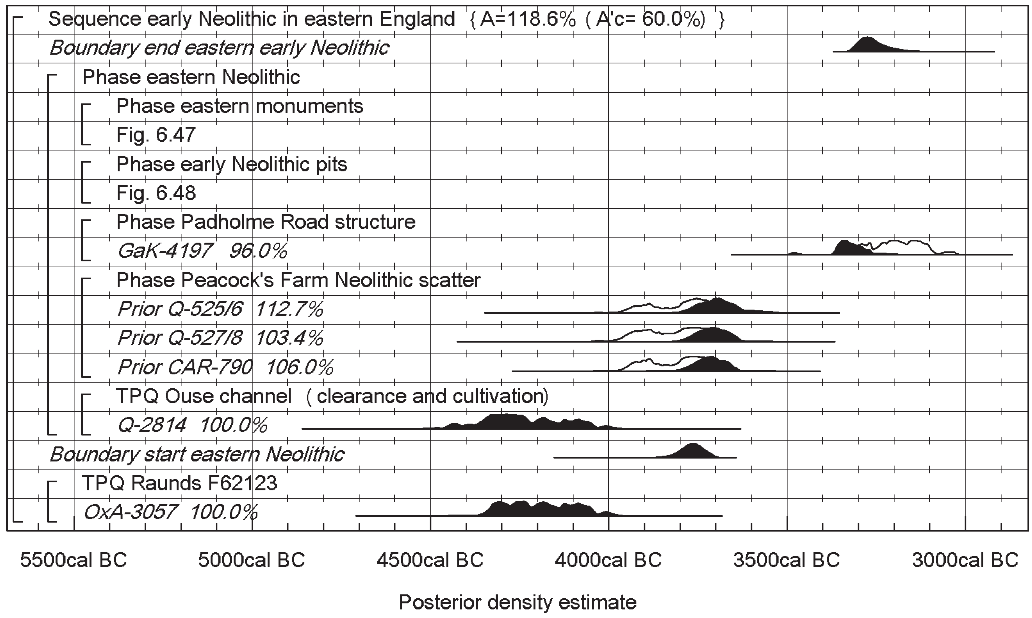


Fig. 6.50. Eastern England. Overall model for the start of the Neolithic. The component sections are taken from the models shown in Figs 6.47–8 without the overall uniform phases (although the posterior density estimates shown on these figures are not those relating to this model). The format is identical to that of Fig. 6.4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

cursus monuments and the long mound at Raunds have been rehearsed above. Whilst it is not impossible that these date estimates will ultimately prove to be reliable, it is of concern that the results of our modelling are currently very sensitive to the inclusion or exclusion of these sites. At the present time, these dates are much earlier than those for other more reliably dated monuments in the region. The Eynesbury dates are outstandingly early for cursus monuments generally, which more typically fall in the second half of the fourth millennium cal BC (Barclay and Bayliss 1999). Claims for early fourth millennium cal BC dates for some Scottish cursus monuments are discussed in Chapter 14. The early date for the long mound at Raunds is also uncertain for the taphonomic reasons set out above; we can note again that that there was Mesolithic and early Neolithic material both under the mound and incorporated in it.

The model shown in Fig. 6.47 suggests that the first construction in this region occurred in *3935–3670 cal BC* (*95% probability*; Fig. 6.47: *start eastern monuments*), probably in *3810–3700 cal BC* (*68% probability*). This is the reading we prefer, because of the uncertainties relating to the dating of the Raunds long mound and the Eynesbury cursus monuments. Figure 6.49 presents three alternative estimates, however, for the date of the first constructions in eastern England. In any of these three cases – that is, if the long mound at Raunds is included in the analysis, or if the cursus monuments at Eynesbury are included, or if the long mound at Raunds and the two cursus monuments at Eynesbury are all included – then our estimates shift earlier, in the first case to *4065–3740 cal BC* (*95% probability*; Fig. 6.49: *start eastern monuments* (no Eynesbury cursus)), probably to *3940–3795 cal BC* (*68% probability*); in the second case to *4070–3675 cal BC* (*95% probability*; Fig. 6.49: *start eastern monuments* (without Raunds long mound)), probably to *3865–3705 cal BC* (*68% probability*); or in the third case to *4165–3750 cal BC* (*95% probability*; Fig. 6.49: *start eastern monuments* (all data)), probably to *3985–3810 cal BC* (*68% probability*).

According to our preferred reading (Figs 6.44 and 6.47), we can see considerable diversity of forms of construction from an early stage. For example, the causewayed enclosure at Etton was initiated in the decades around 3700 cal BC (Fig. 6.33: *start Etton*), as was the mound of the long barrow at Raunds (Fig. 6.27: *Raunds LB*), the avenue at Raunds (Fig. 6.27: *the avenue*) and the primary burial at Whiteleaf (Fig. 6.6: *OxA-13567*). Later examples of these traditions are all present in the region, but the diversity was present from their beginning.

A chronological model for early Neolithic pit-digging east of the Fens is shown in Fig. 6.42. A second model including all the dates from early Neolithic pits in the region as a whole is given in Fig. 6.48. This model suggests that this practice began in *3815–3650 cal BC* (*95% probability*; Fig. 6.48: *start eastern pits*), probably in *3745–3665 cal BC* (*68% probability*). At present there does not seem to be any significant difference between the dates for pits east or west of the Fens (Fig. 6.48), although, given the hundreds of early Neolithic pits which have been excavated in this region, the dated sample is pitifully small.

Figure 6.49 compares our estimated dates for the construction of the first enclosure, the first monument of other form and the first early Neolithic pit in the region. All three practices began within a few generations of each other, in the 38th or early 37th centuries cal BC. Their inceptions are so close in time that it is not possible reliably to calculate the order in which they first appeared.

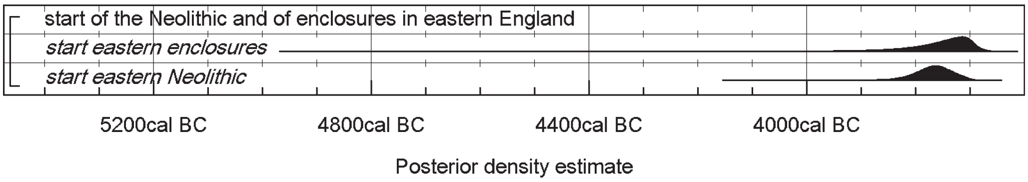


Fig. 6.51. Eastern England. Probability distributions for the start of the Neolithic and the first enclosure, derived from the models defined in Figs 6.44 and 6.50. The format is identical to that of Fig. 6.4.

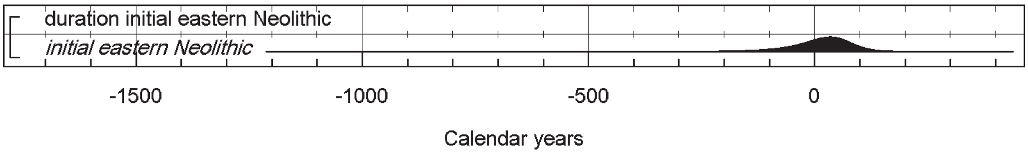


Fig. 6.52. Eastern England. Duration of the initial Neolithic, calculated from the difference between the probability distributions shown in Fig. 6.51.

If other radiocarbon dates associated with early Neolithic cultural material are included in a model for the date of the introduction of new practices as a whole, the overall picture does not change substantively. Figure 6.50 shows the overall structure of this model, the component section for the early Neolithic pits is given in Fig. 6.48, and that for the other monuments is presented in Fig. 6.47. This model suggests that the early Neolithic began in eastern England in *3845–3695 cal BC* (*95% probability*; Fig. 6.50: *start eastern Neolithic*), probably in *3800–3730 cal BC* (*68% probability*). This estimate does not include the dates from the enclosures, and so it can be compared with the date of their introduction (Fig. 6.44: *start eastern enclosures*). These estimates are shown together in Fig. 6.51. It is only *63% probable* that Neolithic practices began before enclosures were first present in this region – it is perfectly possible that enclosures were part of the first manifestations of new ways of doing things. Comparison of these probability distributions provides an estimate of the number of years between the two introductions. This distribution is shown in Fig. 6.52. This suggests that, if enclosures were not present from the beginning, the interval before they first appeared spanned *−160–150 years* (*95% probability*; Fig. 6.52: *initial eastern Neolithic*), probably *−35–90 years* (*68% probability*) – no more than a few generations.

Finally, in this region as elsewhere, it appears that it was cursus monuments which replaced or took over from causewayed enclosures (noting again problems and difficulties with dating many of these sites, not least Eynesbury). Other forms of construction to consider in this regard are the smaller elongated enclosures and small henges, both often associated with cursus monuments (Loveday 1989). Etton and Maxey, in particular, are marked by a plethora of smaller circular monuments, some of which may be of middle Neolithic date (French and Pryor 2005, fig. 2; Pryor 1998, fig.3; Pryor *et al*. 1985, fig. 3). There are, of course, uncertainties remaining in the dating of both kinds of monument in the region, as we have discussed. But Etton provides a striking closing example of causewayed enclosure overlain by cursus, with another (the Maxey cursus) immediately adjacent, and Fornham All Saints an even more vivid case where the cursus not only overlies the twin enclosures but angles to cover both circuits and also to mirror the course of the River Lark nearby.

Notes

1 The dated sample consisted of rings 141–151 of the floating 207-ring tree ring series from this trunk. The mid-point of the dated sample is therefore 60 years older than the last measured ring. Although the ring was heartwood, the evidence suggests that it was probably close to the heartwood-sapwood transition, so that the radiocarbon date has additionally been offset by the empirically derived probability distribution of the number of sapwood rings present in English oak (Bayliss and Tyers 2004, fig. 3). This has been done using the PRIOR, SHIFT and OFFSET functions of OxCal v 3.10.

2 Note added in press: see Beadsmoore *et al*. (2010) for further analysis of deposition at Etton and the suggestion of intermittent use of the enclosure.

7 The Greater Thames estuary

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East of London, the Thames widens into its estuary, to be joined by other rivers, notably the Medway on the Kent side, and the Crouch, Blackwater and Colne on the Essex side (Fig. 7.1). The early fourth millennium cal BC coastline was different to that of the present day. Rises in sea level have been extensive (B. Coles 1998), and lower sea levels would have had a profound effect on the nature and extent of land along this coastal margin. The position

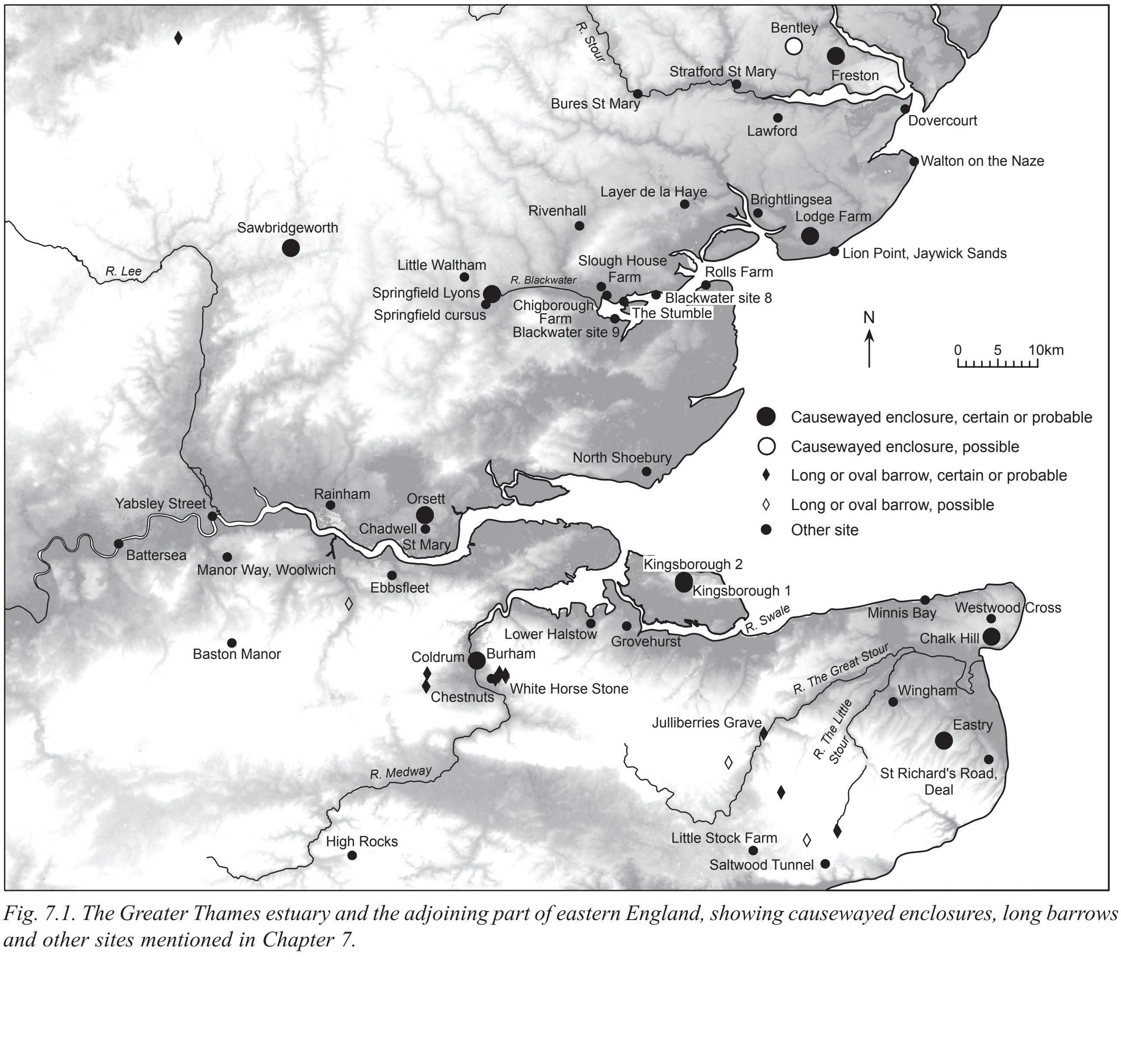


Fig. 7.1. The Greater Thames estuary and the adjoining part of eastern England, showing causewayed enclosures, long barrows and other sites mentioned in Chapter 7.

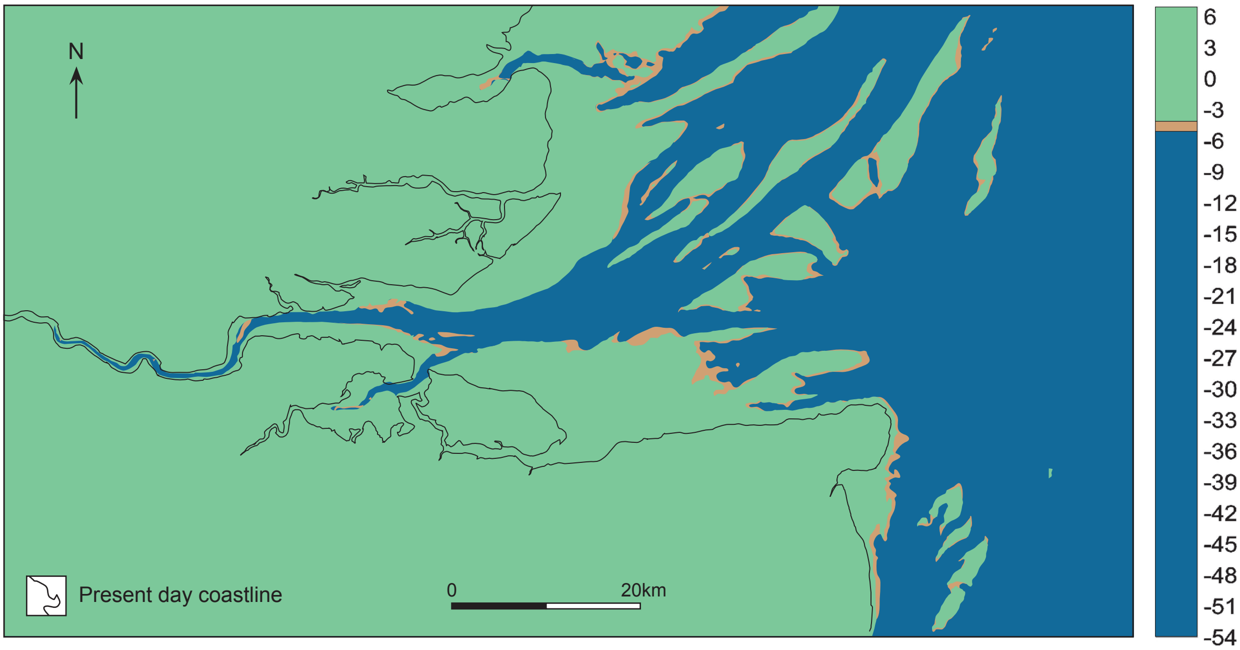


Fig. 7.2. The Thames estuary c. *5500 to 4500 cal BC. Source: Michael J. Allen.*

of the coastline, its distance from the enclosures, and the nature of that now submerged landscape are critical to our interpretation of the communities who occupied the area. The graphs presented by Jelgersma (1979) for the Dutch coast, and the data given by Shennan *et al.* (2000) and Shennan and Horton (2002) for the English side of the southern North Sea, provide reasonable estimates with which to examine the general nature of potential former coastline and its extent across the Kent and Thames estuary. Using the data provided by Jelgersma (1979, fig. V-12), we can suggest that sea level in the first half of the fourth millennium cal BC may have been about −4.5 to −5 m lower than today.

When lower sea levels of −4.5 to −5.5 m are plotted against the known bathymetry of the Thames estuary, an estimate of the extent and distance of the coastline can be given (Fig. 7.2). Around Ramsgate, this is complicated by massive coastal erosion of the chalk cliffs, and Perkins (1998, fig. 8.8) estimates about 1.2 km of cliff line recession in the last 4000 years and possibly up to 1.5–1.7 km in the last 5000 years. The nature of the rivers is not defined, so these are estimated. The overall picture shows an extensive submerged land shelf probably extending 5–7 km off the Isle of Sheppey (Fig. 7.2), and similar distances off the Essex coast.

The character of these former land masses is unknown. Survey and excavation in the Blackwater estuary, however, have indicated a largely wooded landscape, with small clearings, cereal production and quite extensive settlement. To its south, in what is now the eastern end of the Dengie peninsula and the archipelago of marshland islands around Foulness, the tidal limit appears to have been inland of the present range. This whole area appears to have been a complex of tidal sand and upper tidal silt flats interspersed with ridges of shell gravel and sand (Wilkinson and Murphy 1995, 212–7; Murphy and Brown 1999).

Further south again, examination of a deeply stratified (2–10 m) alluvium interspersed with peat in the North Kent Marshes (Firth 2000; Wessex Archaeology 2003) suggests open dry grassland perhaps subject to occasional, but not necessarily seasonal, flooding. This might have provided wide, open and diverse habitats for grazing cattle and for open shrub woodland. There is limited evidence for coastal marsh due to the distance of approximately 7 km between Neolithic and present coastlines. At Gravesend, halophytic saltmarsh communities occurred prior to the transgressive phase and increasing tidal energy and influence may have eroded the upper peat horizon after *c.* 2500–2000 cal BC. Salt marsh soils formed over the later Neolithic (3500–3350 cal BC) sand horizons at Motney and this succumbed to estuarine/ brackish water incursion and a change to alluvial mudflats with strong freshwater water communities. More locally at Queenborough, marsh occurred from about 5500 cal BC (probably fringing the former Swale channel; Wessex Archeology 2003; Mike Allen, pers. comm.).

None of the causewayed enclosures of the greater Thames estuary were immediately next to the coast in the Neolithic period, contrary to their location today. Distances to coastal marsh, where it existed, and to open sea must have varied. The Kent marshes on the Hoo peninsula near Cliffe were evoked by Charles Dickens in these terms, in the flight of Magwitch at the end of *Great Expectations*: 'There was the red sun, on the low level of the shore, in a purple haze, fast deepening into black; and there was the solitary flat marsh; and far away there were the rising grounds…' Whether this was their character also in the Neolithic is a different matter. Nonetheless, the estuary is likely to have been a dynamic, diverse and changing environment in this

Fig. 7.3. St Osyth. Plan of the excavated part of the Lodge Farm enclosure and traces of ditches visible in air photographs. Drawn by Andy Lewsey. © Essex County Council.

period, and the character of the enclosures here may in various ways be connected to this setting.

Parts of this coastline have figured in the Neolithic literature from an early date, witnessed by Hazzledine Warren's work on the 'Lyonesse' surface on the Clacton foreshore (Hazzledine Warren *et al*. 1936) on the Essex side, by the research of Burchell at Lower Halstow near Cliffe on the Kent side, close to where Magwitch came to grief in the estuary (Burchell 1925), and by the work of Burchell and Piggott (1939; cf. Sieveking 1960) at Ebbsfleet near Gravesend. It is fair to say, however, that, following this early work there was something of an hiatus, until the last 20 years or so, when the full potential of the Greater Thames estuary began to be realised (e.g. Wilkinson and Murphy 1995, 1; Bates and Whittaker 2004).

Our knowledge of causewayed enclosures in the area has followed a similar trajectory. None from this zone were listed or mapped by Stuart Piggott in his classic survey (1954, fig. 1) and Rog Palmer (1976a) could list only Orsett, in Essex. The Springfield Lyons and St Osyth enclosures, also in Essex, were found in the 1980s and 2000s during the excavation of sites of later periods in advance of development and quarrying. In Kent, probable causewayed enclosures at Eastry and Burham were discovered by aerial photography in 1976 and 1982. Chalk Hill, Ramsgate, was first detected by aerial photography in 1989 but only recognised as a causewayed enclosure in 1996, to be confirmed by excavation in 1997–8 in advance of road-building (Dyson *et al*. 2000). The first of two causewayed enclosures at Kingsborough on the Isle of Sheppey was discovered during excavation in advance of housing development in 1999, and the second followed in 2004.

7.1 Lodge Farm, St Osyth, Essex, TM 1355 1545

Location and topography

The Neolithic enclosure at Lodge Farm, St Osyth, lies at 15 m OD on a low spur of gravel, 3 km west of Clacton-on-Sea, 3 km inland from the broad embayment formed by the mouths of the Colne and Blackwater estuaries, and tilted northwards towards the St Osyth creek which flows into Brightlingsea Creek, which in turn joins the Colne estuary (Fig. 7.1). Submerged Neolithic occupation sites have been salvaged off the present coast at Jaywick and Lion

Point, Clacton, south-east of the site (Hazzledine Warren *et al*. 1936), and investigated higher up the Blackwater valley to the south-west, most notably at The Stumble (Wilkinson and Murphy 1995; N. Brown 1997; Wilkinson *et al.* forthcoming). A dense palimpsest of cropmarks (Germany 2007, fig. 6) within which the enclosure lies includes a possible cursus monument to the south-east of the enclosure and a possible small henge to the west (Germany 2007, 6, figs 5, 67).

History of investigation

From May 2000 to February 2003 excavations in advance of mineral extraction, directed by Mark Germany for the Essex County Council Field Archaeology Unit, and funded by Sewell's Reservoir Construction Limited, Essex County Council and English Heritage via the Aggregates Levy Sustainability Fund, unexpectedly revealed the remains of a very large Neolithic causewayed enclosure with three irregular circuits (Fig. 7.3; Germany 2007). If the inner ditch in the east of the excavated area and the single ditch in the south-west formed part of a single circuit, it would be oval in plan, measuring approximately 200 m by 300 m, and, if complete, would have enclosed an area of approximately 5 ha. The remains of two further circuits were recovered on the south-eastern side of the site. The full plan of the enclosure has not been determined. A local cover of clay and silt means that only parts of it have appeared in air photography, and it has not been subject to earthwork or geophysical survey. The mineral extraction has destroyed 4.5 ha of the enclosure, although the rest is likely to remain largely intact.

Large, elongated, conjoined segments, 1–6.4 m wide and 0.4–1.5 m deep (Fig. 7.3), define the circuits which are 27 m to 40 m apart. Recuts and indirect evidence for internal banks can be seen in some of the fill sequences. The most substantial part of the enclosure is the inner circuit, where some of the segments are 1.5 m deep (Figs 7.4–5). Generally the ditches contained few finds, although there were seven concentrations of artefacts, mainly of Mildenhall Ware sherds. Grooved Ware was recovered from some of the upper ditch fills (Germany 2007, 11–13, 33).

Within the ditches, mostly on the western side, were approximately 117 small pits, sometimes arranged in small groups of two or more. The fills of approximately half of these features were dark with carbonised wood and plant

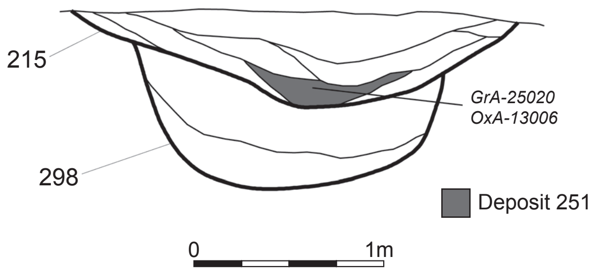


Fig. 7.4. St Osyth. Section of segment 13930 of the middle circuit of the Lodge Farm enclosure, showing the context of the samples for GrA-25020 and OxA-13006. Drawn by Andy Lewsey. © Essex County Council.

Fig. 7.5. Excavation at St Osyth. Photo © Essex County Council.

remains, the remainder being similar to the surrounding natural sand; a few had been recut. Artefacts were generally concentrated in charcoal-rich deposits, and a small number of pits contained large concentrations of material. There was little sign of deliberate placement, but a hint of selection, in that rim and upper body sherds seemed disproportionately frequent among the pottery (Germany 2007, 25–9). Bone was no longer present because of the acidic nature of the sand and gravel. The abundant assemblage of Mildenhall Ware from the site had a limited and restrained repertoire of decoration compared with, for example, Etton.

Both Grooved Ware and Beaker were deposited in pits and other contexts. A pond barrow was built inside the inner circuit in the Early Bronze Age. Scorched ground and an unurned cremation within the pond barrow indicate that it was used for cremation pyres, as do cremations in Collared Urns on the outside edge of it. A few ring ditches may also be of this date. In the Middle Bronze Age the pond barrow continued in use; a large group of small ring ditches were dug; and cremation deposits were buried in Ardleigh style Bucket Urns. In the Middle Iron Age a settlement of roundhouses, post-built structures, enclosures and trackways was established over the earlier prehistoric features (Germany 2003; 2007).

Previous dating

A full programme of radiocarbon dating and statistical modelling was undertaken in 2003–4 as part of the post-excavation analysis of the site (Hamilton *et al*. 2007). Its results for the Neolithic activity on the site are summarised here.

Objectives of the 2003–4 dating programme

The principal aims of this dating programme were to determine the dates of construction and use of the causewayed enclosure, to date the Neolithic pits and determine whether they were contemporary with the enclosure, and to provide absolute dates for Mildenhall Ware.

Sampling strategy

The initial step in sample selection was to identify short-lived material that was probably not residual in the contexts from which it was recovered. All the samples consisted of single entity samples of carbonised material (Ashmore 1999a). Carbonised residues adhering to the interior faces of Mildenhall Ware sherds and charred hazelnut shells were the materials dated.

Results and calibration

Nineteen samples from Neolithic activity at St Osyth were dated. Full details of these samples and the radiocarbon measurements obtained are provided in Table 7.1.

Samples were dated in 2003 and 2004. Those dated by the Oxford Radiocarbon Accelerator Unit were prepared using methods outlined by R. Hedges *et al*. (1989a) and measured as described by Bronk Ramsey *et al*. (2004b). Those dated by the Rijksuniversiteit Groningen were processed and dated as described by Aerts-Bijma *et al*. (1997; 2001) and van der Plicht *et al*. (2000).

Analysis and interpretation

Samples from a total of eleven contexts thought to belong to the Neolithic phase of activity at St Osyth were submitted for radiocarbon dating. Ten were pits within the causewayed enclosure and the eleventh was a lower fill (251) of a recut in the middle circuit of the enclosure ditch, 215 (Table 7.1). Seven of the dated pits were within the inner circuit of the enclosure. Two others, 96 and 103, lay immediately north of middle ditch segment 13930 and may be contemporary with the dated recut, as all three fills contained exceptionally large amounts of waste flint material, suggesting a flint working area in this part of the site. These pits may have lain in a causeway of the middle ditch circuit, although the limit of excavation makes this uncertain. Finally, pit 13817 lay in the space between the middle and outer circuits, closer to the middle ditch (Fig. 7.3).

Two hazelnut shells were dated from each of eight Neolithic pits and the recut in the enclosure. The pairs of measurements from six of the pits and the recut are statistically consistent (pit 96, context 98: T'=0.1; T'(5%)=3.8; ν=1; pit 1114, context 1129: T'=0.0; T'(5%)=3.8; ν=1; pit 4060, context 4082: T'=1.5; T'(5%)=3.8; ν=1; pit 5819, context 5821: T'=1.4; T'(5%)=3.8; ν=1; pit 6088, context 6089: T'=0.4; T'(5%)=3.8; ν=1; pit 13817, context 13818: T'=1.0; T'(5%)=3.8; ν=1; recut 215, context 251: T'=1.2; T'(5%)=3.8; ν=1). This suggests that no residual material was dated from these features. The pairs of measurements from two other pits are not statistically consistent (pit 103, context 102: T'=5.2; T'(5%)=3.8; ν=1; pit 1432, context 1433: T'=3.9; T'(5%)=3.8; ν=1,), although, as these pairs fail a χ^2 test at 95% confidence but pass at 99% confidence, they are likely to represent outlying measurements rather than redeposited material.

A carbonised residue was dated from a single sherd of Mildenhall Ware recovered from pit 1189, context 1191 (OxA-12978). The radiocarbon measurement on this sherd is 3800±650 BP. The large error associated with this measurement was due to the low carbon content of the graphitised sample. This result has not been used in the analyses and mathematical modelling, as it is so imprecise that it is not useful. One other carbonised residue, on a single sherd of Mildenhall Ware, was dated by both laboratories (OxA-13008 and GrA-25022). The sherd was recovered from pit 2340, context 2341. These results were statistically consistent (T'=0.0; T'(5%)=3.8; ν=1), and so the measurements from this sample were combined before calibration.

The chronological model for the Neolithic enclosure and pits at Lodge Farm is shown in Fig. 7.6. There are no stratigraphic relationships between samples, and so

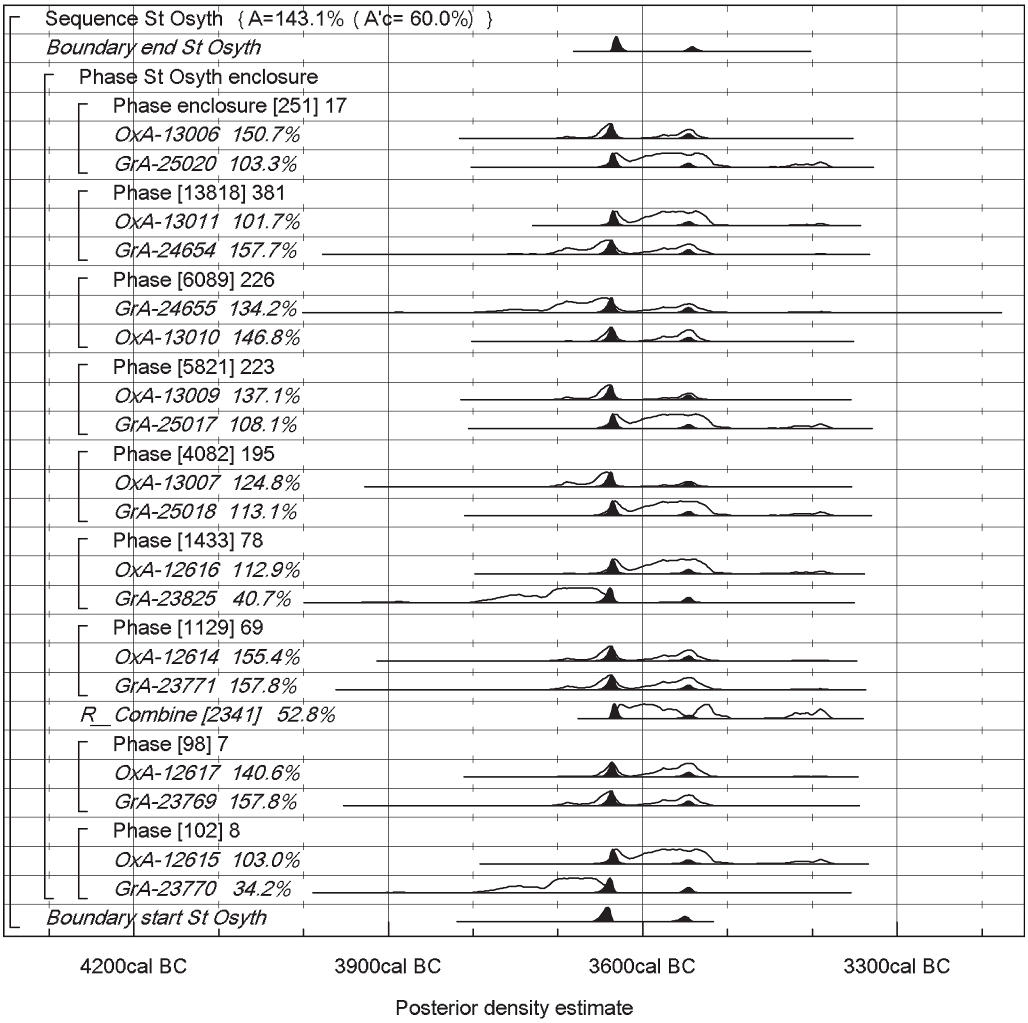


Fig. 7.6. St Osyth. Probability distributions of dates from the Lodge Farm enclosure. Each distribution represents the relative probability that an event occurred at a particular time. For each of the dates two distributions have been plotted, one in outline which is the result produced by the scientific evidence alone, and a solid one which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution 'start St Osyth' is the estimated date for the start of Neolithic activity on the site. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

the model simply incorporates the assumption that the Neolithic activity on the site formed a single, continuous phase of activity (see Chapter 2.4.1).

For St Osyth, this is an assumption worthy of some consideration as there is no certainty that the pits within the circuits of the enclosure are part of the same phase of use as the enclosure itself. They could, for example, have been dug some time later within a visible earthwork. All 19 samples, however, have provided statistically consistent radiocarbon measurements (T'=23.5; T'(5%)=28.9; ν=18), suggesting a relatively short period of use for the site within the Neolithic. The potential contemporaneity of the recut in the middle ditch 215 and pits 96 and 103, suggested on the basis of flintworking debris, has already been mentioned. Spatially, some other pits seem to form contemporary groups (e.g. pits 5819, 5817 and 5758). There is some time depth to the Neolithic pits, however, as a few stratigraphic relationships were observed between them. From the dated examples, only pit 4060 cuts another (pit 4084 which contained no finds or carbonised plant remains). The association of the pit digging with the use of the enclosure circuits may also be suggested by the fact that the area inside each of the ditches, which may have been occupied by banks, seems to have been devoid of such pitting. Although we cannot entirely exclude the possibility that the initial construction of the circuits came before internal pits were dug, this seems unlikely given the limited spread of the radiocarbon determinations from these features and the speed of infilling of ditches cut into gravel. For all these reasons, the early Neolithic activity at St Osyth has been modelled as part of the same, uninterrupted phase of activity relating to the use of the enclosure.

This model suggests that Neolithic activity on the site, and potentially the initial construction of the causewayed enclosure, date to *3660–3630 cal BC* (*70% probability*; Fig 7.6: *start St Osyth*) or *3565–3540 cal BC* (*25% probability*), probably to *3655–3635 cal BC* (*61% probability*) or *3555–3545 cal BC* (*7% probability*). This period of activity, and

Table 7.1. Radiocarbon dates from Lodge Farm, St Osyth, Essex. Posterior density estimates derive from the model defined in Fig. 7.6.

Laboratory Number	**Sample reference**	**Material**	**Context**	**Radiocarbon Age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Middle ditch								
GrA-25020	[251] 17A	Hazelnut shell	Context 251. Third fill of recut (215) at the north end of causewayed enclosure ditch 13930, part of the middle circuit. The fill contained 350 g of Mildenhall Ware and almost 2.5 kg of worked flint (Germany 2007, 13, 31, fig. 17)	4775±40	−22.7		3650–3380	*3650–3620* (*69%*) or *3560–3535* (*26%*)
OxA-13006	[251] 17B	Hazelnut shell	From the same context as GrA-25020	4832±33	−22.1		3660–3530	*3650–3625* (*69%*) or *3555–3535* (*26%*)
Pits								
OxA-12617	[98] 7A	Hazelnut shell	Context 98. Second fill (of three) of pit (96), which contained 4.5 kg of cores, chips and unfinished flint tools (Germany 2007, 24–9)	4812±35	−25.3		3660–3520	*3650–3625* (*69%*) or *3560–3535* (*26%*)
GrA-23769	[98] 7B	Hazelnut shell	From the same context as OxA-12617	4830±40	−25.6		3700–3520	*3650–3625* (*69%*) or *3560–3535* (*26%*)
OxA-12615	[102] 8A	Hazelnut shell	Context 102. Single fill of pit (103), which contained 6.8 kg of cores, chips and unfinished flint tools and 400 g of Mildenhall Ware (Germany 2007, 24–9)	4777±37	−25.3		3650–3380	*3645–3625* (*69%*) or *3560–3535* (*26%*)
GrA-23770	[102] 8B	Hazelnut shell	From the same context as OxA-12615	4910±45	−27.0		3790–3630	*3655–3630* (*69%*) or *3555–3535* (*26%*)
OxA-12614	[1129] 69A	Hazelnut shell	Context 1129. Primary fill of pit (1114), which contained more than 4 kg of worked flint and over 2 kg of Mildenhall Ware (Germany 2007, 24–9)	4828±37	−23.0		3660–3530	*3650–3625* (*69%*) or *3555–3535* (*26%*)
GrA-23771	[1129] 69B	Hazelnut shell	From the same context as OxA-12614	4825±45	−24.5		3700–2520	*3650–3625* (*69%*) or *3560–3535* (*26%*)
OxA-12616	[1433] 78A	Hazelnut shell	Context 1433. Primary fill of recut in pit (1432), which contained 600 g of worked flint and over 2.2 kg of Mildenhall Ware (Germany 2007, 24–9)	4787±37	−23.7		3650–3380	*3650–3625* (*69%*) or *3560–3535* (*26%*)
GrA-23825	[1433] 78B	Hazelnut shell	From the same context as OxA-12616	4910±50	−22.5		3800–3630	*3655–3630* (*69%*) or *3555–3535* (*26%*)
OxA-13007	[4082] 195A	Hazelnut shell	Context 4082. Primary fill of pit (4060), which contained 280 g of worked flint and over 2.2 kg of Mildenhall Ware (Germany 2007, 24–9)	4850±34	−23.0		3700–3530	*3655–3630* (*69%*) or *3555–3535* (*26%*)
GrA-25018	[4082] 195B	Hazelnut shell	From the same context as OxA-13007	4785±40	−23.2		3650–3380	*3650–3625* (*69%*) or *3560–3535* (*26%*)
OxA-13009	[5821] 223A	Hazelnut shell	Context 5821. from the primary fill of pit (5819), which contained 1.4 kg of worked flint and 930 g of Mildenhall Ware (Germany 2007, 24–9)	4840±31	−25.0		3700–3530	*3650–3630* (*69%*) or *3555–3535* (*26%*)
GrA-25017	[5821] 223B	Hazelnut shell	From the same context as OxA-13009	4780±40	−28.3		3650–3380	*3650–3625* (*69%*) or *3560–3535* (*26%*)
GrA-24655	[6089] 226A	Hazelnut shell	Context 6089. from the fill of pit (6088), which contained 1 kg of Mildenhall Ware and 240 g of worked flint (Germany 2007, 24–9)	4860±60	−25.0		3770–3520	*3655–3625* (*69%*) or *3560–3535* (*26%*)
OxA-13010	[6089] 226B	Hazelnut shell	From the same context as GrA-24655	4820±31	−24.5		3660–3520	*3650–3625* (*69%*) or *3555–3535* (*26%*)
OxA-13011	[13818] 381A	Hazelnut shell	Context 13818. from the primary fill of pit (13817), which contained 90 g of Mildenhall Ware and 190 g of worked flint (Germany 2007, 24–9)	4780±31	−22.5		3650–3380	*3645–3625* (*69%*) or *3560–3535* (*26%*)

Laboratory Number	Sample reference	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-24654	[13818] 381B	Hazelnut shell	see OxA-13011	4840±50	−26.7		3710–3520	*3650–3625* (*69%*) or *3560–3535* (*26%*)
OxA-12978	[1191]	Carbonised residue	Context 1191. from the second (top) fill of pit (1189), containing 70 g of Mildenhall Ware and 15 g of worked flint (Germany 2007, 24–9)	3800±650	−28.4		3950–590	
OxA-13008	[2341]A	Carbonised residue	Context 2341. from the fill of pit (2340), which contained 2.6 kg of Mildenhall Ware and 440 g of worked flint (Germany 2007, 24–9)	4745±33	−27.3	4743±27 T′=0.0; T′(5%)=3.8; ν=1	3640–3370	*3640–3620* (*70%*) or *3560–3535* (*25%*)
GrA-25022	[2341]B	Carbonised residue replicate	Replicate of OxA-13008	4740±45	−29.0			

the use of the enclosure, ended in *3640–3620 cal BC* (*69% probability*; Fig 7.6: *end St Osyth*) or *3550–3530 cal BC* (*26% probability*), probably in *3640–3625 cal BC* (*61% probability*) or *3545–3540 cal BC* (*7% probability*).

The duration of Neolithic activity on the site is estimated to have been *1–35 years* (*95% probability*; Fig 7.7), probably *1–20 years* (*68% probability*) – within the span of a single generation.

This estimate for the duration of activity at St Osyth provides further information about the date of the enclosure. Figure 7.6 shows that the posterior density estimates produced by the model are strongly bimodal. The fact that the estimate for the duration of this activity is so short, and has a single peak, suggests that all of the dated activity dates either to the earlier or to the later peak, but not to both. If some of the pits dated to the earlier peak and others to the later peak, a bimodal distribution would be expected for the duration of the activity (see also Chapter 2.4.1, and Chapter 8.4 for the comparable example of Abingdon).

The chronological model presented in Fig. 7.6 has good convergence (C=99.8%; Bronk Ramsey 1995, 429; Chapter 2.4), although in order to produce such stability over 28 million iterations were required. This is because the sampler concentrates in two discrete areas of the calendrical axis, producing the bimodal probability distributions shown in Fig. 7.6. This bimodality is caused by the pronounced wiggle in the calibration curve around 3600 cal BC (Fig. 2.17).

Implications for the site

St Osyth has three circuits and is potentially large. Such characteristics have often been taken to suggest long duration. The one-generation timescale derived from the model is quite at odds with this interpretation. The dearth of suitable samples from the ditches makes it impossible to resolve this apparent anomaly. The pits may have been dug during one period of use of the site, comparable to unenclosed pit clusters like those at Kilverstone or Hurst Fen (Garrow *et al*. 2005; J.G.D. Clark 1960), and the poorly dated ditches during other episodes. Alternatively, large numbers of people may have gathered to build and use the entire complex within the generation indicated by the model. This project has suggested other examples of short duration for large enclosures, which we will examine further in Chapters 14 and 15. Overall, we prefer a short chronology for St Osyth, perhaps akin to those of Maiden Castle and Abingdon (Chapters 4 and 8), given the likely speed of gravel fillings in the ditches, though that cannot be compressed into just one episode, because of recutting of pits and ditches alike.

7.2 Orsett, Thurrock, Essex, TQ 6515 8055

Location and topography

The causewayed enclosure at Orsett lies on gently sloping ground on the edge of the 30 m or Boyn Hill Terrace of the

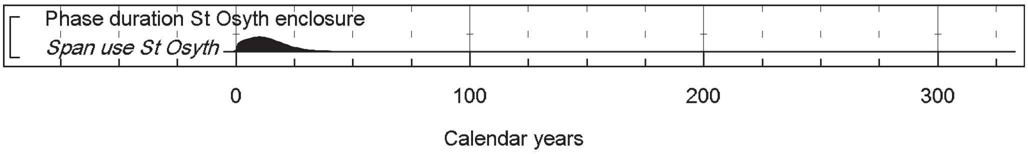


Fig. 7.7. St Osyth. Probability distribution of the number of years during which the Lodge Farm enclosure was in primary use, derived from the model shown in Fig. 7.6.

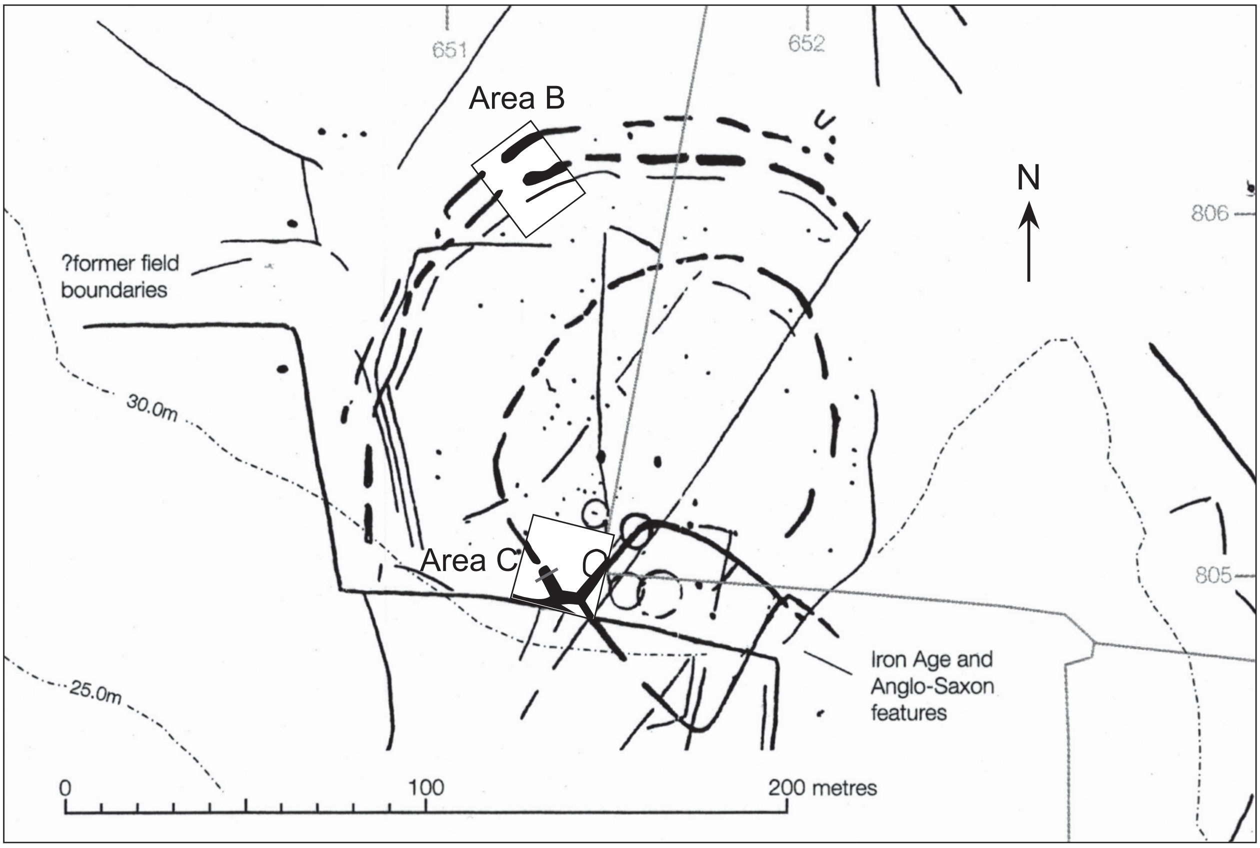


Fig. 7.8. Orsett. Plan showing cuttings. After Hedges and Buckley (1978, fig. 5) and Oswald et al. *(2001, fig. 3.11).*

lower Thames (Hedges and Buckley 1978, fig. 1). There are expanses of sands and gravels all around, and cropmarks, including a long 'mortuary' enclosure about 1 km to the south-west (Strachan 1996; N. Brown 1997, 90), are dense in the area, also principally on the 30 m terrace (Hedges and Buckley 1978, fig. 4). The ground rises steadily from the Thames, and a series of small tributaries and dry valleys dissect the terrace. The causewayed enclosure itself lies above three such, to the south, west and east, giving its position some local prominence (Hedges and Buckley 1978, 221). The Thames runs to the south in a great bend from Grays to Tilbury and Gravesend and beyond into the Lower Hope reach. It is closest at just over 4 km away to the east, and to the south is still only about 6 km distant at Tilbury. Inland, the broad expanse of Orsett Fen lies 3 km to the north-east. No other causewayed enclosures are known nearby (Fig. 7.1), the closest being Springfield Lyons, 30 km to the north (D. Buckley *et al.* 2001, 150–2, fig. 32).

History of investigation

The plough-levelled site was first photographed from the air in 1961 (Oswald *et al.* 2001, 151) and was subsequently scheduled. It is part of a complex of overlapping and intersecting cropmarks (Hedges and Buckley 1978, fig. 3), but the enclosure can be recognised as two quite closely spaced outer arcs of interrupted ditch, with a palisade close inside these, together with a third, innermost, and more complete, circuit of interrupted ditch (Fig. 7.8). The incompleteness of the outer circuits may be due either to the conditions in which the aerial photograph was taken or to erosion on the slopes of the terrace.

Excavation was undertaken in 1975 in order to confirm the presumed date and character of the site and determine its state of preservation (Hedges and Buckley 1978, 219). The excavation comprised two principal cuttings: Area B, 25 m by 20 m over the outer two circuits and the palisade,

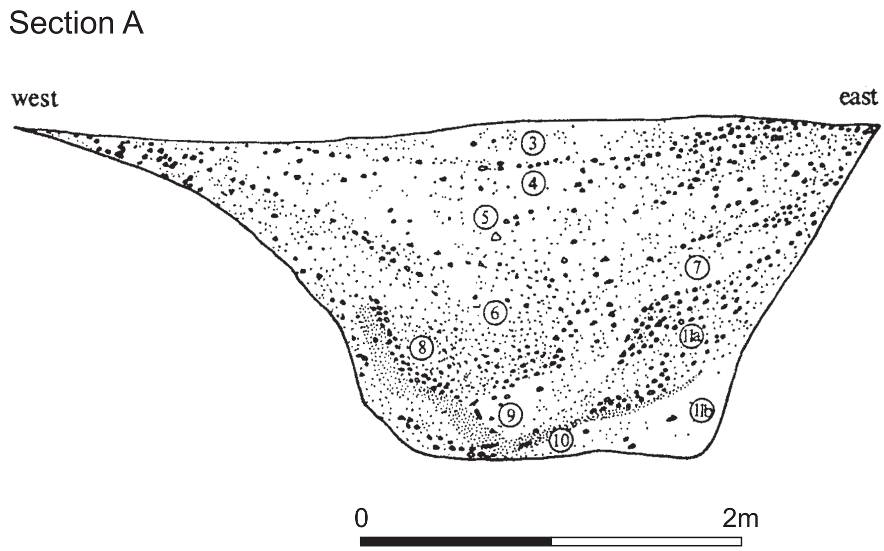


Fig. 7.9. Orsett. Section through inner ditch. After Hedges and Buckley (1978, fig. 13).

and Area C, 30 m by 30 m designed largely to examine other cropmarks but which also allowed investigation of a short stretch of the inner ditch (Fig. 7.9). Both the outer two ditches were of similar dimensions, 4 m wide by 1.5 m deep with relatively steep sides and flat bottoms. They had originally been dug as 'a series of large contiguous ovoid pits with the gravel 'bridge' remaining in some instances' (Hedges and Buckley 1978, 228). Silting of both was judged to be natural, while the pattern of the fills of the outermost ditch suggested that there had been an earthwork, mooted as a 'turf revetted bank', between them – occupying a space only around 6 m wide (Hedges and Buckley 1978, 228, 234). Since the effects of the putative bank could not be seen clearly in the fill of the middle ditch, it was questioned whether these two circuits were of identical date (Hedges and Buckley 1978, 236). Nor is there conclusive evidence that the middle ditch had its own internal bank (Hedges and Buckley 1978, 236).

The palisade ran concentric with the outer two ditch circuits, roughly 3–4 m behind the middle ditch. It was not quite continuous; it was 0.80 m wide and 0.75 m deep, with some deeper post sockets forming an irregular base. Postpipes could be seen, some with charcoal-rich deposits, suggesting *in situ* burning of palisade posts (Hedges and Buckley 1978, 238); others were seen as rotted *in situ* (Hedges and Buckley 1978, 244). There was no definite evidence for a continuous run of posts.

The excavation of Area B (Hedges and Buckley 1978, fig. 6) allowed an entrance through the outer ditch circuits and palisade to be seen in detail. The outer and inner ditch causeways were aligned, and were around 6 m broad. There were scattered postholes and other small features on the inner ditch causeway. Roughly in the middle of this there was also a larger feature interpreted as a postpit, F58, cut by two postholes (Hedges and Buckley 1978, 242). The palisade was accompanied by numerous postholes (Hedges and Buckley 1978, figs 6 and 14). It was interrupted on the same line as the ditch causeways, and a shorter stretch of palisading was set back covering this entrance, such that people entering would have been funnelled to either side. A large postpit (F14) in the centre of this space suggests the former presence of a double gate (Hedges and Buckley 1978, 238). Some of the postholes were thought of as a later blocking (Hedges and Buckley 1978, 238). The paucity of finds from the palisade was taken to suggest an early date for it (Hedges and Buckley 1978, 242). The features F10 and F21, slot and pit respectively, with more finds, were also taken as later restrictions on entrance access (Hedges and Buckley 1978, 242). Different constructional phases were therefore suspected, but could not be elucidated on the field evidence alone (Hedges and Buckley 1978, 244).

Only two short lengths of the inner ditch were excavated in Area C, on either side of a causeway; the ditch was 4 m wide, had steep sides and a flat base like the outer circuits, but was deeper (*c*. 2 m). Silting was basically natural and no bank was indicated by the fills (Fig. 7.9). However, there were a series of 'variable and intermittent deposits of charcoal rich loams, pottery, flint and stone', in shallow, circular, small lenses or pits, often together with burnt sand and gravel (Hedges and Buckley 1978, 237). These were a feature particularly of the primary fills, close to the northern ditch terminal, but also occurred higher up. The overall impression was of 'successive placings or dumping of small amounts of material quickly covered with sand and gravel and later sometimes recut' (Hedges and Buckley 1978, 237). No identifiable bone came from Neolithic contexts (Hedges and Buckley 1978, 293).

In the small area of the interior opened inside the inner ditch there were few identifiable Neolithic features. A concentration of postholes, however, was taken to represent a Neolithic oval structure some 11 m by 8 m, with a large irregular pit (F121) in its centre, the majority of the pottery from which was Mildenhall Ware, although Grooved Ware and Beaker were also present (Hedges and Buckley 1978, 246–7, figs 7 and 21).

Pottery, flint and stone were the principal finds. These

Table 7.2. Radiocarbon dates from Orsett, Essex. Posterior density estimates derive from the model defined in Fig. 7.10.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Features in entrance area							
BM-1213	1731/BF14 (3)	Unidentified bulk charcoal sample	Area B, F14, layer 3. Posthole in centre of entrance, midway between two butts of palisade (Hedges and Buckley 1978, figs 14, 16)	4741±113	−24.0	3750–3130	*3775–3335*
BM-1377	1731/BF45 (3)	Unidentified bulk charcoal sample. Charcoal from this context was identified by Caroline Cartwright as *Quercus* sp. (Hedges and Buckley 1978, 293)	Area B, F45, layer 3. Pit S of palisade (Hedges and Buckley 1978, figs 6, 16)	4620±43	−25.5	3520–3190	*3525–3335*
BM-1378	1731/BF85 (4)	Unidentified bulk charcoal sample	Area B, F85, layer 4. Posthole within larger post pit 58 in gate structure in entrance causeway of middle ditch, containing Mildenhall sherds (Burleigh and Matthews 1982, 153) *or* Area B, F84, layer 4. Postpipe in palisade trench inside entrance (Hedges and Buckley 1978, 238, 295). Both contexts are illustrated (Hedges and Buckley 1978, figs 6, 14, 16)	4726±74	−24.3	3660–3350	*3640–3370*
Inner ditch							
BM-1215	1731/CF4 IV (10)	Unidentified bulk charcoal sample	Area C, F4, IV, layer 10. Base of primary silts of N butt of S segment of inner ditch, which contained Mildenhall pottery (Hedges and Buckley 1978, figs 7, 13)	4585±82	−25.3	3630–3020	*3635–3555 (19%)* or *3540–3395 (76%)*
GrA-31104	1731/CF4 IV (11a)	Internal residue on large, well-preserved Neolithic Bowl body sherd	Area C, F4, IV, layer 11a. Just above base of primary silts of N butt of S segment of inner ditch, which contained Mildenhall pottery, stratified above layer 10 (Hedges and Buckley 1978, 236–7, figs 7, 13)	4695±40	−27.3	3640–3360	*3520–3365*
BM-1380	1731/CF4 IV (5)	Unidentified bulk charcoal sample	Area C, F4, IV, layer 5. Middle silts of N butt of S segment of inner ditch, which contained Grooved Ware (Hedges and Buckley 1978, figs 7, 13)	3871±62	−23.5	2550–2140	
BM-1379	1731/CF4 I (3)	Unidentified bulk charcoal sample. Charcoal from this context was identified by Caroline Cartwright as *Corylus* sp. (Hedges and Buckley 1978, 293)	Area C, F4, I, layer 3. Upper silts of S butt of N segment of inner causewayed ditch, which contained EIA pottery (Hedges and Buckley 1978, figs 7, 12)	2514±81	−24.3	820–390	
Middle ditch							
BM-1214	1731/BF2 II (6)	Unidentified bulk charcoal sample	Area B, F2, II, layer 6. Top of primary silts of W butt of E segment of middle ditch, which contained Mildenhall pottery (Hedges and Buckley 1978, figs 6, 11)	4533±112	−22.7	3630–2900	*3635–3115*

were more numerous from the inner ditch than from the outer circuits (Hedges and Buckley 1978, 237). Most of the pottery was from the lower fill of the inner ditch. Only one sherd came from the palisade; only five interior features in Area B and ten in Area C yielded sherds (Kinnes 1978, 259, 263). The assemblage was in the Mildenhall style, with open bowls in the majority and typical heavy rims. Only ten vessels were decorated, mainly with fine incision and fluting (Kinnes 1978, 263–6). Mostly local gravel flint was used, and lithics were not abundant. A typical repertoire from the lower ditch fills (Bonsall 1978, 255–6) included cores, waste, serrated and notched flakes, scrapers, and one polished axe, probably of non-local flint. The few stone finds are all believed to be non-local, including puddingstone and sandstone, some pieces being from querns (Hedges and Buckley 1978, 290).

Previous dating

Following the excavation, seven bulk charcoal samples were dated by the British Museum (Hedges and Buckley 1978, 295; Burleigh and Matthews 1982, 152–3), the samples being prepared and measured as described by Burleigh *et al.* (1976). BM-1213 came from the possible central gate post F14 in a row of postholes between the two terminals of the palisade in the entrance in Area B (Hedges and Buckley 1978, fig. 6: F14). BM-1378 has two alternative contexts, both of which were postholes relating to the entrance (Table 7.2; Hedges and Buckley 1978, 238, fig. 6: F84 or F85; Burleigh and Matthews 1982, 153). Since the charcoal in both filled distinct postpipes (Hedges and Buckley 1978, 238, 242, fig. 16), it was almost certainly a charred post that was dated. BM-1377 came from a pit which was one of a row of features immediately behind the palisade trench, interpreted as possible bracing or structural support posts for the palisade (Hedges and Buckley 1978, 238). Although the charcoal from these features was not identified, that from 13 others in the entrance area was of oak, in one case accompanied by alder (Cartwright 1978). The samples may therefore also have been of oak. For this reason, and because the samples were bulked, the results can be treated only as *termini post quos*. The same holds true for BM-1214, from top of the primary silts of the middle ditch in this area.

A sequence of three samples was dated from the inner ditch in Area C (Table 7.2: BM-1380, -1215, -1379). Only BM-1215 was from an earlier Neolithic level, the initial silt with its charcoal-rich lenses (Hedges and Buckley 1978, 237, fig. 13: L10). The unidentified bulk sample provides a *terminus post quem* for the overlying layers. The remaining two dates (BM-1380, -1379) are from layers respectively containing Grooved Ware and Early Iron Age pottery.

Objectives of the dating programme

The main aims were to establish the sequence of construction and duration of use of the various elements of the complex, and to relate the site to the Neolithic occupation of the surrounding area.

Sampling strategy and simulation

These intentions were frustrated because no charcoal survived from the excavations and because carbonised residues on pottery had either been absent or had with rare exceptions been thoroughly cleaned off. The only additional sample which could be submitted was a carbonised residue (Table 7.2: GrA-31104).

Results and calibration

Full details of all the radiocarbon measurements from the site are listed in Table 7.2.

Analysis and interpretation

The model for the chronology of the complex is shown in Fig. 7.10.

All three samples (BM-1213 and -1377–8) from *features in the entrance area* produced measurements which are statistically consistent (T'=2.2; T'(5%)=6.0; ν=2), which suggests that the interpretation that they relate to structures which functioned together is plausible. These dates are used as *termini post quos* for the entrance since they consisted of unidentified charcoal which might have an age offset. In *the middle ditch*, a *terminus post quem* for all but the initial silting is provided by *BM-1214*.

In *the inner ditch, BM-1215* came from the lowest layer and provides a *terminus post quem* for the overlying layers. *GrA-31104*, which was stratified immediately above it, was measured on carbonised residue from a large, well preserved sherd and should be close in age to its context. The third and first millennium cal BC dates from the upper layers (Table 7.2: BM-1380, -1379) are not included in the model.

On this slender foundation, the model indicates that the inner ditch at Orsett was dug in *3520–3365 cal BC* (*95% probability*; Fig. 7.10: *build Orsett inner*), probably in *3450–3370 cal BC* (*68% probability*). The middle ditch was dug in or after *3635–3115 cal BC* (*95% probability*; Fig. 7.10: *BM-1214*), probably in or after *3625–3605 cal BC* (*2% probability*) or *3525–3390 cal BC* (*40% probability*) or *3385–3280 cal BC* (*26% probability*). Structures in the entrance area, which should have functioned together with the middle ditch, may have been built in or after *3520–3325 cal BC* (*94% probability*; Fig. 7.10: *build Orsett entrance*) or *3215–3190 cal BC* (*1% probability*), probably in *3490–3395 cal BC* (*44% probability*) or *3390–3355 cal BC* (*22% probability*).

There are insufficient radiocarbon measurements from the Orsett circuits for the model to determine the span of use of the enclosure with any precision. It should be noted, however, that all six results from the primary fills and structures associated with the enclosure are statistically consistent (T'=5.0; T'(5%)=11.1; ν=5). Potentially, therefore, the period of primary use could be very short.

A sensitivity analysis

The consistency of the radiocarbon determinations made

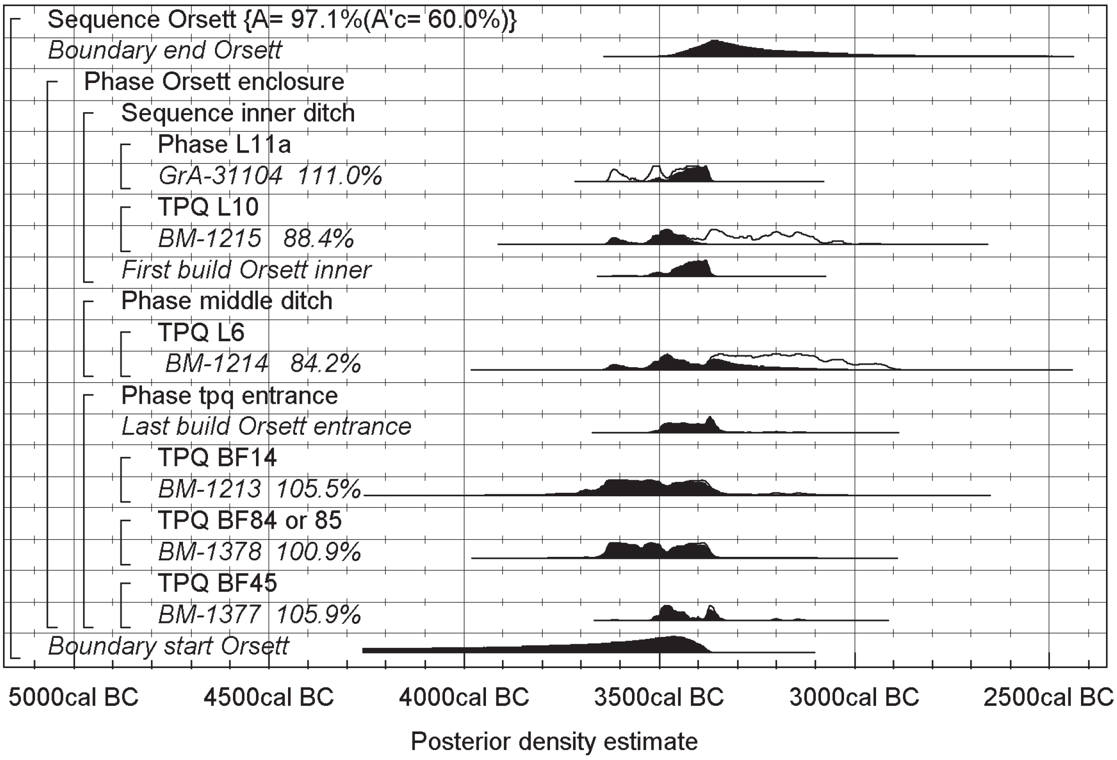


Fig. 7.10. Orsett. Probability distributions of dates. The format is identical to that of Fig. 7.6. The model is defined exactly by the brackets down the left-hand side of the diagram.

on unidentified bulk charcoal samples is striking. If these samples had contained charcoal fragments of a range of actual ages (either through bulking together fragments which had in reality been deposited at different times, or through the incorporation of material with significant age offsets), then each sample could be expected to incorporate a different proportion of residual or long-lived material and the results would have been inconsistent. The unexpected consistency of these measurements may therefore suggest that these samples did not contain significant proportions of old wood, and derived from specific burning events. The latter is certainly feasible, since all the samples seem to have come from either concentrations of charred remains in restricted areas of the ditches or from structural timbers (Table 7.2). In at least one case (BM-1378), this timber seems to have been relatively slight (0.30 m in diameter if this sample derived from F85 (4) in Area B (Hedges and Buckley 1978, figs 6 and 16); 0.20 m if it derived from F84 (4) in Area B (Hedges and Buckley 1978, fig. 14)).

In our view this circumstantial evidence is suggestive, but insufficient to form the basis of the chronology for the Orsett enclosure. This is why the model presented in Fig. 7.10 has treated all the results from unidentified samples as *termini post quos* for the contexts from which they were recovered. An alternative view, in which all these samples are assumed to be from short-lived material and related to single archaeological events, is presented in Fig. 7.11. This model provides a broadly similar chronology to that derived from our preferred model (Fig. 7.10), suggesting perhaps a fairly restricted period of use in the 35th or earlier 34th centuries cal BC (Fig. 7.11), and a substantial interval between the causewayed enclosure and later activity.

Implications for the site

The inner circuit of the Orsett causewayed enclosure appears to have been constructed in *3520–3365 cal BC* (*95% probability*; Fig. 7.10: *build Orsett inner*), probably in *3450–3370 cal BC* (*68% probability*). Both the digging of the middle ditch and the building of a timber entrance could be contemporary with the construction of the inner circuit; the possibility of a unitary construction for all three circuits and the palisade is certainly compatible with the radiocarbon dating. The dating evidence is, however, scarce, and is also compatible with piecemeal construction of the complex over a few generations.

It is even more difficult to determine the period during which the complex was in use. The statistical consistency of the radiocarbon determinations might suggest a relatively restricted period of use, perhaps even just a generation or two. The field evidence could be taken to suggest that it could have been in use for longer: based on differences in silting in the outer and middle ditches and on remodelling of the entrance. But is that interpretation mainly based on lack of precise chronological control?

The enclosure does seem to have gone out of primary use in the third quarter of the fourth millennium cal BC (Fig. 7.10), perhaps even by 3300 cal BC (Fig. 7.11). This suggests that there is likely to have been a substantial interval between the abandonment of the enclosure and the

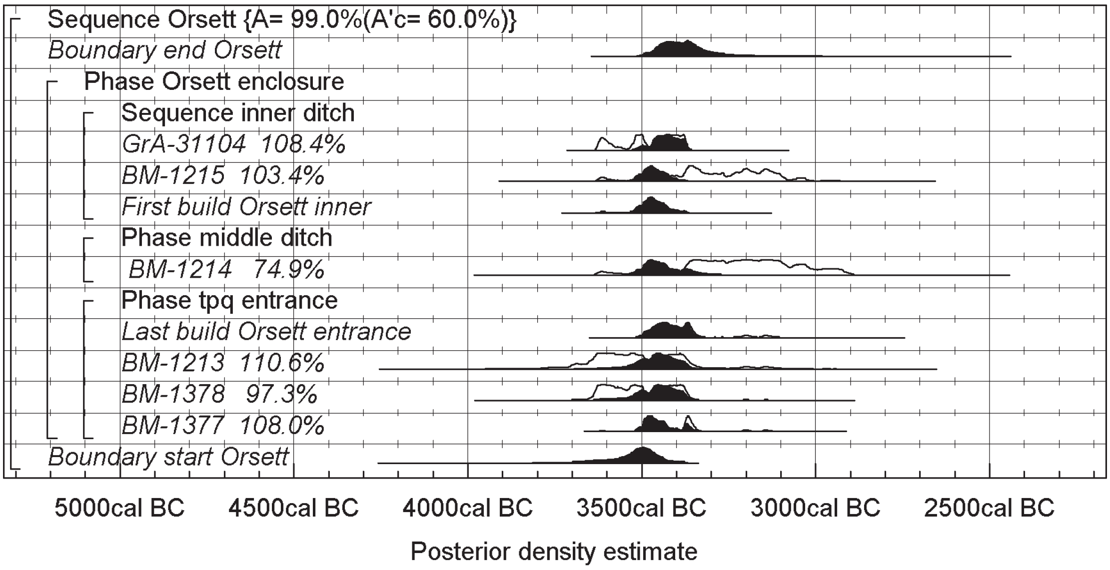


Fig. 7.11. Orsett. Probability distributions of dates from an alternative model for the causewayed enclosure at Orsett, assuming that all the unidentified charcoal samples were from relatively short-lived timber. The format is identical to that of Fig. 7.6. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

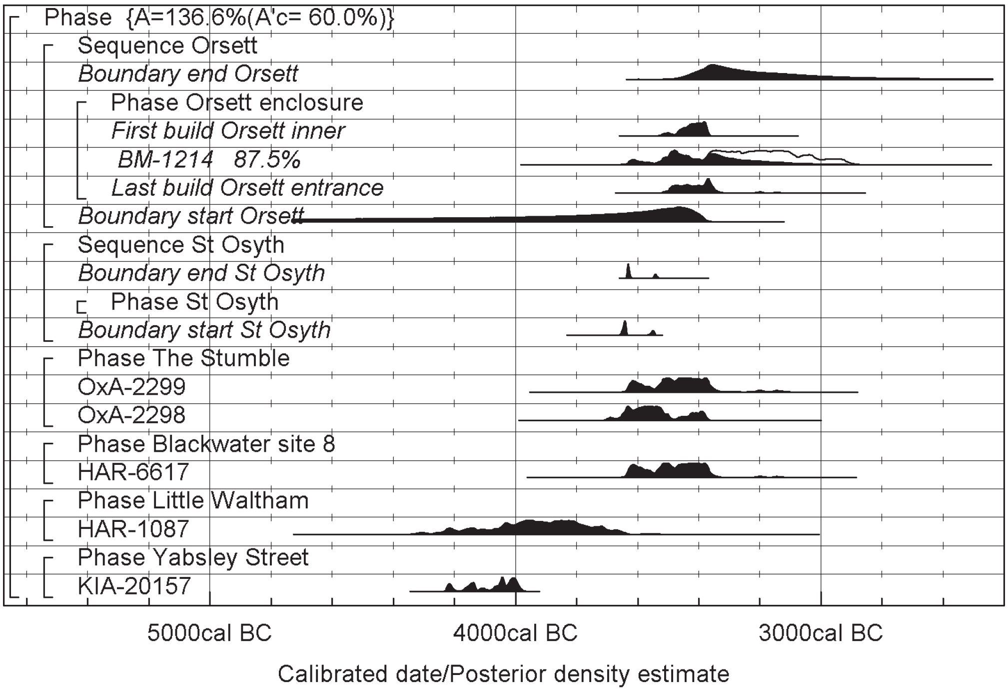


Fig. 7.12. St Osyth and Orsett. Probability distributions of key events, derived from the models shown in Figs 7.6 and 7.10, and calibrated radiocarbon dates from other sites of the period in the region (Stuiver and Reimer 1993). The format is identical to that of Fig. 7.6.

resumption of significant activity on the site, as witnessed by Grooved Ware and later finds.

7.3 The Essex side of the Thames estuary

It is *99% probable* that the causewayed enclosure at St Osyth was constructed and abandoned before that at Orsett was built (Fig. 7.12). Both enclosures formed part of a dwelt-in landscape, which would have included both coast and estuary (Fig. 7.2), about which we know little directly, as set out above. The scene presented in Fig. 7.2 might suggest, however, that both Orsett and the Kingsborough sites on Sheppey were so placed as to mark in some way the narrowing of the estuary after the confusion of the outer banks and channels.

We know relatively little about the immediate dryland setting of Orsett beyond the possible long mortuary enclosure about 1 km to the south-west mentioned above.

A small number of early Neolithic finds have been made at nearby Mucking (J. Hedges 1980, 27), and 2 km to the south-west of the enclosure a single pit recorded in an evaluation trench at Chadwell St Mary yielded a large part of a plain neutral uncarinated Bowl and a small amount of struck flint, probably from the knapping of two pebbles (Brown and Ennis 1999). On the gravel terrace at Launders Lane, Rainham, Greater London, about 12 km west of Orsett, a ring ditch contained large sherds of carefully placed Mildenhall Ware (J. Hedges 1980, 34). Nearby settlement was recovered at Brookway, on the edge of Rainham Marsh, where there were a less well preserved Mildenhall Ware assemblage, an associated flint industry, and pits and postholes cut into alluvium-covered gravel (J. Hedges 1980, 27–8, 34; J. Lewis 2000, 68). Burials as well as settlement can be found in such alluvium-covered contexts, as evidenced by an inhumation accompanied by a waterlogged oak plank, a flint knife, flint flakes and a substantial fragment of a Carinated Bowl beneath alluvium and peat on the present Thames floodplain at Yabsley Street, Blackwall, London (S. Coles *et al*. 2008). A radiocarbon date on the plank, derived from oak sapwood (S. Coles *et al.* 2008, 227), provides a date for the burial of 4230–3970 cal BC (95% confidence; Fig. 7.12: KIA-20157). Its relationship to settlement and monuments remains unknown. Another facet of early fourth millennium treatment of human remains is seen in a human cranium of unknown cultural affinities dredged from the Thames farther upstream at Battersea and dated to 3910–3510 cal BC (95% confidence; distribution not shown; Table 7.3: OxA-1199; Bradley and Gordon 1988). Since only a few of the hundreds of crania from the river have been dated, others may be equally early.

To the east of Orsett settlement evidence largely consists of lithic finds (J. Hedges 1980). However, in an area of deep loess deposits at North Shoebury, some 30 km from the enclosure, a series of layers, often charcoal-rich, 0.15–0.45 m deep and around 30 m long, were recorded in the face of a brickearth quarry. They yielded an undecorated ceramic assemblage which included very fine Carinated Bowls and at least one very large carinated cooking or storage vessel (Wymer and Brown 1995).

Settlements are better known in the present intertidal zone in the surrounds of St Osyth, notably in the Blackwater estuary upstream to the south-west of the enclosure, and on the foreshore around Clacton-on-Sea, immediately to the east, and Walton-on-the-Naze and Dovercourt a little farther north-eastward (Hazzledine Warren *et al.* 1936). In general terms, these areas would have remained dry land up to the late third millennium cal BC (Wilkinson and Murphy 1995, fig. 135; Murphy and Brown 1999, 13), so that the features and scatters eventually sealed by peats and clays span an extended period, from Mesolithic to Beaker.

Scatters of both Mesolithic and earlier Neolithic artefacts line the Blackwater estuary, as they do the Crouch estuary to the south (Wilkinson and Murphy 1995, figs 37, 45). On the Blackwater these are sometimes associated with charcoal spreads, which are abundant in the same zone, or with pits, such as an isolated example containing Mildenhall Ware at Blackwater site 9 (Wilkinson and Murphy 1995, 83–4, 128), or with both, as at Blackwater site 8. The length of time through which the surface remained accessible is reflected in dates for two charcoal spreads here, one (Fig. 7.12: HAR-6617) possibly contemporary with the artefacts, the other dating to 2860–2295 cal BC (95% confidence; 4000±70 BP; HAR-6618).

The two most thoroughly investigated sites were Rolls Farm and The Stumble. The Bowl pottery from Rolls Farm, Tollesbury, less than 20 km up the Blackwater estuary from St Osyth, is predominantly light-rimmed, thin-walled and carinated, although a few Mildenhall elements are present (N. Brown 1995, 131, fig. 77). At The Stumble, Goldhanger, 5 km or so to the south-west again, late Mesolithic and both earlier and later Neolithic occupation areas were distinct on what would have been a dry land site 2–3 m above high water mark and more than 1 km inland (Wilkinson and Murphy 1995, figs 50, 129; Wilkinson *et al.* forthcoming). The earlier Neolithic occupation yielded a characteristic Mildenhall Ware assemblage, although decoration was confined to only one of the areas investigated, suggesting successive episodes (N. Brown 1995, 131, figs 78, 79; N. Brown forthcoming). There were both postholes and pits, dates from one of each indicating that the occupants of the site could have been alive at the time of the St Osyth enclosure (Fig. 7.12: OxA-2298, -2299), although the use of the enclosure could also precede the dated occupation at The Stumble (Wilkinson and Murphy 1995, 76–81; N. Brown 1997, Wilkinson *et al.* forthcoming). Although postholes were frequent, the small size of the excavated areas and the multi-period character of the excavation hampered the identification of building plans. A wide range of plant remains were found, including cereals, berries, nuts, roots and tubers; pollen analysis suggested little clearance. Seasonal occupation has been considered (N. Brown 1997, 94).

The Clacton, Walton and Dovercourt sites yielded a range of early Neolithic finds of pottery and flint, sometimes from pits and hearths (Hazzledine Warren *et al*. 1936; I. Smith 1954). Lion Point, Clacton, in particular has both Mildenhall pottery and lighter-rimmed bowls with carinations and more open profiles (Hazzledine Warren *et al*. 1936, pl. XXXIX, fig. 1).

The gravels north of the Blackwater were also occupied, on the evidence of several pit groups (N. Brown 1997, 92), each perhaps the surviving fraction of a settlement or occupation like those more fully preserved in the estuary. At Chigborough Farm there were also a number of post-built rectangular structures (Adkins and Adkins 1984; 1992; Darvill 1996c, 103, fig. 6.4: 3; Wallis and Waughman 1998, 63–5). Ceremonial use of this zone in addition to the St Osyth enclosure is evidenced by the discovery at Brightlingsea, 6.5 km north-east of St Osyth, of a segmented D-plan ring ditch with a single causeway and multiple recuts containing an assemblage of Mildenhall Ware, including two halves of a single pot placed on either side of the entrance (Lavender 1995; 1996; Holgate 1996,

Table 7.3. Radiocarbon dates from Battersea and Yabsley Street, Blackwall, London; and The Stumble, Blackwater site 8, and Little Waltham, Essex.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**
Battersea						
OxA-1199	BMNH RCS 4.7191	Human cranium	One of numerous skulls dredged from this stretch of the Thames at this location in the nineteenth century. Most of the few other dated examples are middle or late Bronze Age (Bradley and Gordon 1988)	4880±80		3910–3510
Yabsley Street, Blackwall						
KIA-20157		Waterlogged oak plank. 'Tyloses were absent from the spring vessels in the wood examined suggesting an origin in sapwood' (S. Coles *et al.* 2008, 227)	Context 155. Plank set on edge along one side of grave containing an adult inhumation, possibly female and accompanied by a substantial fragment of a Carinated Bowl, a flint knife and flint flakes (S. Coles *et al*. 2008)	5252±28	−22.3±0.2	4230–3970
The Stumble						
OxA-2298	BL 28C.270	Charred hazelnut shell	Area C, posthole 269, context 270. Contained charcoal flecks, small fragment decorated Mildenhall Ware, animal bone, much burnt flint (Wilkinson and Murphy 1995, 76–80, table 18; Wilkinson *et al*. forthcoming)	4780±70	−27.5	3700–3370
OxA-2299	BL 28c. 266	Charred emmer grains	Area C, pit 265, context 266. Contained charcoal flecks, decorated Mildenhall Ware (Wilkinson and Murphy 1995, 76–80, table 18; Wilkinson *et al*. forthcoming)	4675±70	−24.8	3640–3340
Blackwater site 8, Bradwell on Sea						
HAR-6617	BL8. 32	*Quercus* charcoal	Spread of charcoal (exclusively oak) on buried land surface with artefact scatter and two pits, one of which contained plain Bowl pottery (Wilkinson and Murphy 1995, 84–90, tables 18, 24–5)	4690±70	−25.2	3640–3340
Little Waltham						
HAR-1087		Bulk charcoal sample. Remainder identified as *Corylus/Alnus* sp. by Rowena Gale	Pit 251, containing plain light-rimmed Bowl pottery including a carinated vessel. One of only 3 certainly or possibly Neolithic features on N periphery of extensive excavated area (Drury 1978, 10–11, 51, 118, figs 7, 36)	5120±130	−25.4	4260–3640

19; Clarke and Lavender 2008). There are also at least four cropmark long barrows or long 'mortuary' enclosures (Buckley *et al*. 1988, figs 9–10), which may also be of earlier fourth millennium date. An excavated example at Slough House Farm is undated, a *terminus ante quem* being provided by a semi-complete Beaker from a topmost fill (Wallis and Waughman 1998, 9, figs 7–8; N. Brown 1998, fig. 95: 10).

These elongated enclosures form part of a distribution which extends upriver on to the gravels of the Chelmsford area, where one is aligned with the Springfield cursus, built in a meander of the river Chelmer, below the ridge on which the Springfield Lyons causewayed enclosure lies (D. Buckley *et al*. 2001, fig. 32). There are no absolute dates for the initial phases of the cursus. The best pointer to its construction date is a spread of Mortlake Ware sherds, many of them from a single pot, in a lens overlying some 0.25 m of primary silt in the ditch forming the east end of the monument (D. Buckley *et al*. 2001, fig. 11, fig. 19: 7–14). Given that the gravel primary silt would have accumulated rapidly, the cursus would have been built after Peterborough Ware had come into use, and before the deposition of Grooved Ware in the topmost surviving fill of the ditch, in a charcoal-rich layer, bulk charcoal samples from which are dated to 2835–2460 cal BC (95% confidence; Buckley *et al*. 2001, 112, 122–3, fig. 11; 4023±46 BP; weighted mean of HAR-6266, -6268 and -6271). It would, in other words, have post-dated the construction of the St Osyth and Orsett enclosures, and by analogy also the Springfield Lyons enclosure. In the Chelmsford area too there is abundant settlement evidence (N. Brown 1997, 88).

In the Chelmsford area, on the Blackwater, on the present Essex foreshore and the Thames estuary, plain, light-rimmed, Carinated Bowl is less frequent than Mildenhall Ware. It occurs in non-monumental contexts, and, where those contexts are closed, tends to occur alone. Examples include the Yabsley Street burial (Coles *et al.* 2008), a pit at Layer de la Haye, south of Colchester (J. Hedges 1982, fig. 4, pl. I), pits at Slough House Farm, above the Blackwater estuary (Wallis and Waughman 1998, 9, fig. 6), and a pit at Little Waltham, north of Chelmsford (Drury 1978, 10–11, fig. 36). At the last, the identification of the undated fraction of a bulk charcoal sample as of short-life species (Table 7.3) means that the feature may possibly date from the first centuries of the fourth millennium cal BC (Fig. 7.12: HAR-1087).

7.4 Kingsborough 1 and 2, Isle of Sheppey, Kent, TQ 9757 7200, TQ 9757 7230

Location and topography

The Kingsborough causewayed enclosures lie on a low hill forming the high point of the Isle of Sheppey. They occupy an elevated position at about 70 m OD, close to the north-eastern end of the ridge which extends west-east along the island, with commanding views to the north and east over the Thames and Essex coast, and south over the Swale marshes (Figs 7.1–2). The ridge comprises a complex of drift geology including Bagshot Beds sand, Claygate Beds, and Head deposits over London Clay (Dines *et al*. 1954; Holmes 1981). The north slope of the ridge is steep former cliff (Nicholls *et al.* 2000) and overlooks the Thames estuary, whereas the south slope, facing towards the Swale Marshes, is less steep. Locally this topography is significant in that each of the causewayed enclosures has a specific and identifiable viewshed. Kingsborough 1 lies on the southern slope, below the crest, with a southerly aspect, and Kingsborough 2 is at the crest, and clearly has a northerly aspect. The area has been under plough and pasture, and prior to excavation (1999–2004), in advance of housing development, there was little known prehistoric activity on the Isle of Sheppey, but the estuarine fringes show deep alluvial deposits with buried peat and possible human activity (Firth 2000). This highlights again the importance of the location of the former sea level.

History of investigation

Evaluation in advance of housing was undertaken by Archaeology South-East, and subsequent excavations (M. Allen *et al.* 2008) led to the discovery and exposure of about one-third of a causewayed enclosure with three circuits on the southern aspect of Kingsborough Farm (Fig. 7.13); some sections were excavated across the ditches. This is known as Kingsborough 1. It had a maximum dimension of approximately 160 m, and all three circuits appear polygonal in plan, each composed of a series of relatively straight ditch segments. More than 20 sections were cut across the ditches. Discrete Neolithic features were confined to a posthole between the inner and middle ditches, two postholes and a pit within the inner ditch and a posthole outside the enclosure. Later, the inner ditch was further sectioned and sampled by Wessex Archaeology in order to obtain a detailed sequence of environmental samples (Fig. 7.14). The inner ditch was up to 2 m wide and 0.90 m deep with a V-profile, the middle ditch up to 2.50 m wide and 1.20 m deep with a flat bottom and steep sides, and the outer and largest ditch of similar profile and up to 2.60 m wide and 1.70 m deep.

A second causewayed enclosure with a single circuit, Kingsborough 2, was discovered in 2004, during further excavation by Wessex Archaeology in advance of extended housing development, approximately 200 m due north of Kingsborough 1 (Fig. 7.13; M. Allen *et al.* 2008). Only a small portion of this was exposed within the development area, but it seems to have a D-shaped plan opening over the scarp slope. No internal Neolithic features were identified. The ditch was generally steep-sided and flat-bottomed, and up to 1.70 m wide and 1.20 m deep.

Between the two monuments is a circular Bronze Age hilltop enclosure. Middle to Late Bronze Age cremations forming a dispersed cemetery occur around and within the Bronze Age enclosure but respected the causewayed enclosures. Iron Age and Saxon features were also present within both enclosures.

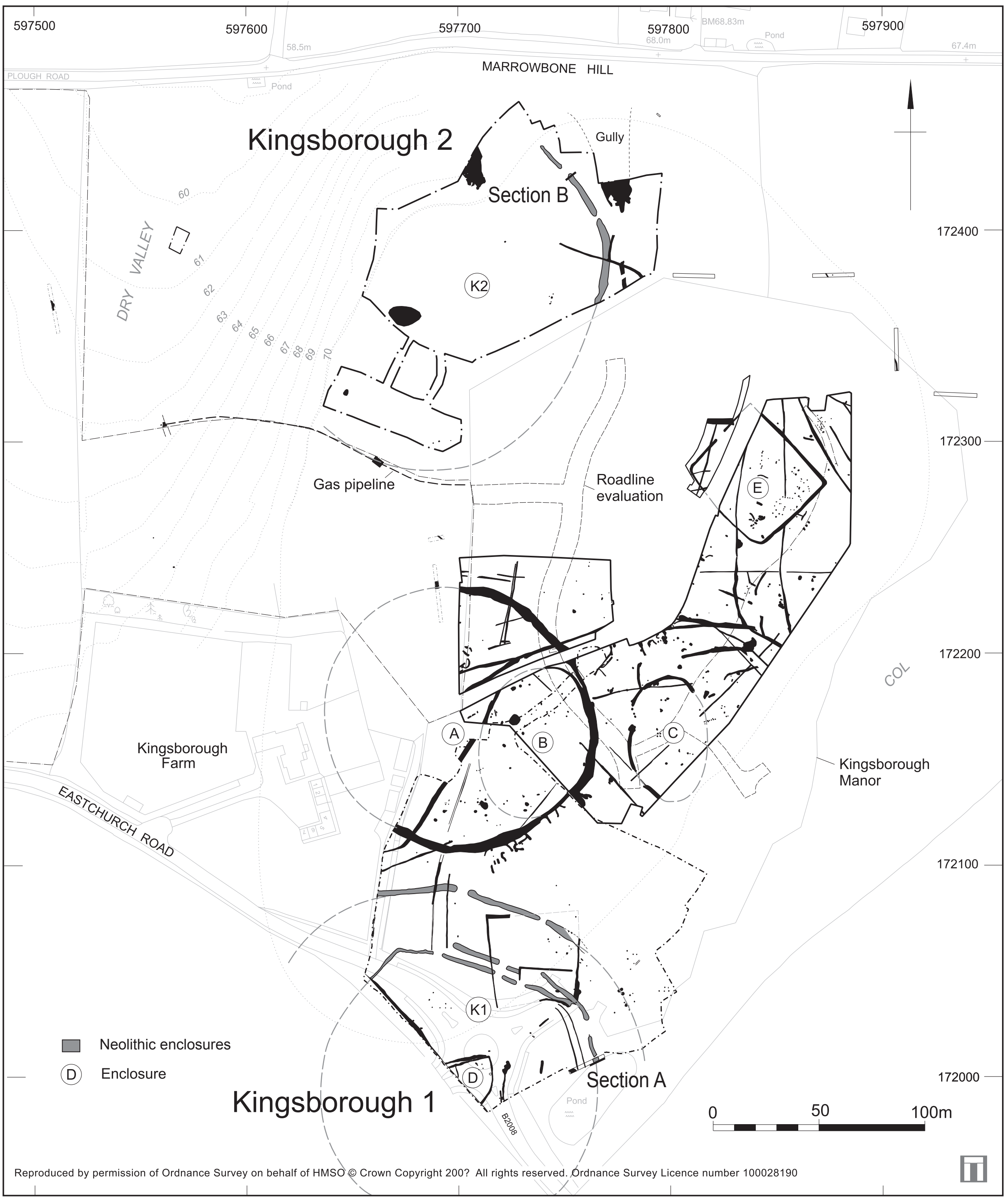


Fig. 7.13. Kingsborough 1 and 2. Plan showing relation of Neolithic enclosures to each other, on either side of a Late Bronze Age enclosure, with the extent of excavated areas and location of reproduced sections. © Wessex Archaeology.

The drift geology resulted in only weakly calcareous deposits, and very little bone was preserved. The artefact assemblages include a large quantity of Decorated Neolithic Bowl pottery with Mildenhall affinities from Kingsborough 1, where finds were concentrated in the inner circuit (with much less material in the middle circuit, and very little in the outer), and a smaller amount from Kingsborough 2, where finds were scarcer and concentrated in or near the bottom of the ditch. Charred plant and charcoal remains were recovered from processed samples.

A sequence of pollen samples starting just above the primary silt of segment 3 of the Kingsborough 2

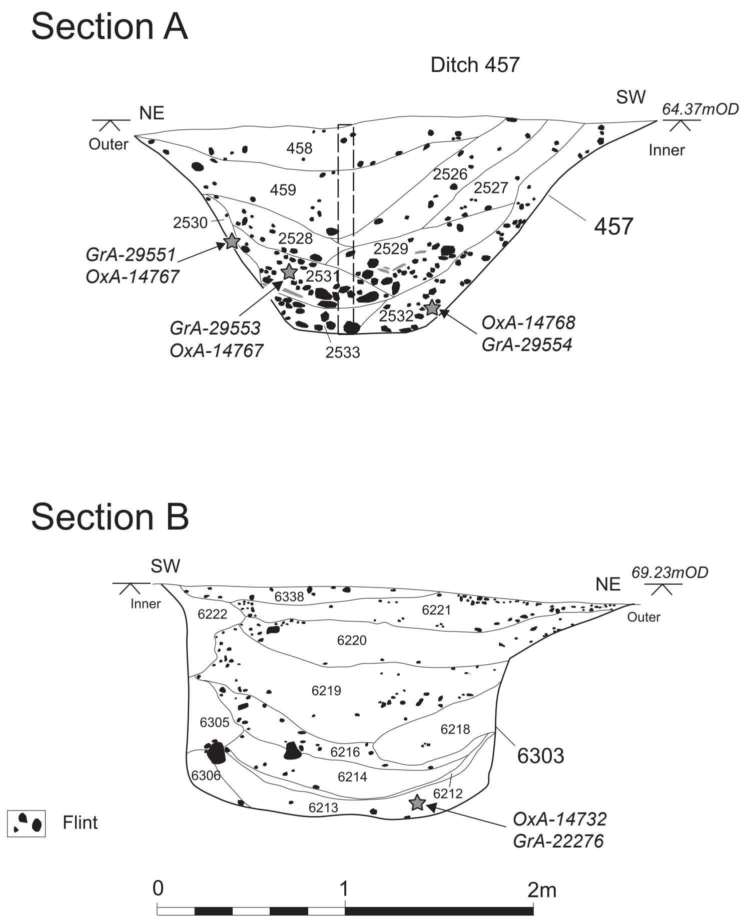


Fig. 7.14. Kingsborough 1 and 2. Sections of F457 of Kingsborough 1 inner ditch (A) and segment 2 of Kingsborough 2 ditch (B). © Wessex Archaeology.

ditch reflected low frequencies of tree and shrub pollen throughout, the dominant vegetation during the infilling of the ditch being open grassland, with some cereals and weeds of cultivation, which were concentrated at the base of the secondary fills. Charred cereals were correspondingly present in both enclosures (Scaife 2008).

Objectives of the dating programme

The first samples from Kingsborough 1 were submitted in the early stages of post-excavation analysis to determine whether the enclosure fell broadly within the timespan of Neolithic causewayed enclosures.

A second series of samples was then selected, following the excavation of both enclosures, to answer the following questions: were Kingsborough 1 and 2 in contemporary use? Was either Kingsborough enclosure contemporary with the example at Chalk Hill? What was the longevity of the use of the Kingsborough enclosures?

These samples were selected as part of a single dating strategy, but were funded in partnership by the developers, Jones Homes (Southern) Ltd, and the Arts and Humanities Research Council, through this project.

Sampling strategy

Dating had by necessity to rely on charred plant remains, since the preservation of bone and shell on the hilltop was very poor. A single placed deposit of animal bone from the primary fill of segment 2 at Kingsborough 2 survived because it was charred and substantial enough to create a micro-environment suitable for bone preservation. Unfortunately this material was insufficiently calcined for dating as cremated bone, and sufficiently charred for any remaining collagen to have been denatured. Consequently it could not be dated.

The potential taphonomy of each sample was considered carefully before submission. Material was selected from discrete concentrations of charred plant remains or charcoal from primary fills. Such caches potentially indicate discrete disposal events occurring early within the ditch filling process. Two further samples from similar deposits in the tertiary fills were dated to provide *termini ante quos* for the use of the monuments.

Finally, a carbonised residue adhering to the interior surface of a Neolithic pottery sherd was dated. This sample dates the primary fill from which the sherd was recovered, and also provides a direct date for the fabric group.

Material suitable for dating from the Kingsborough

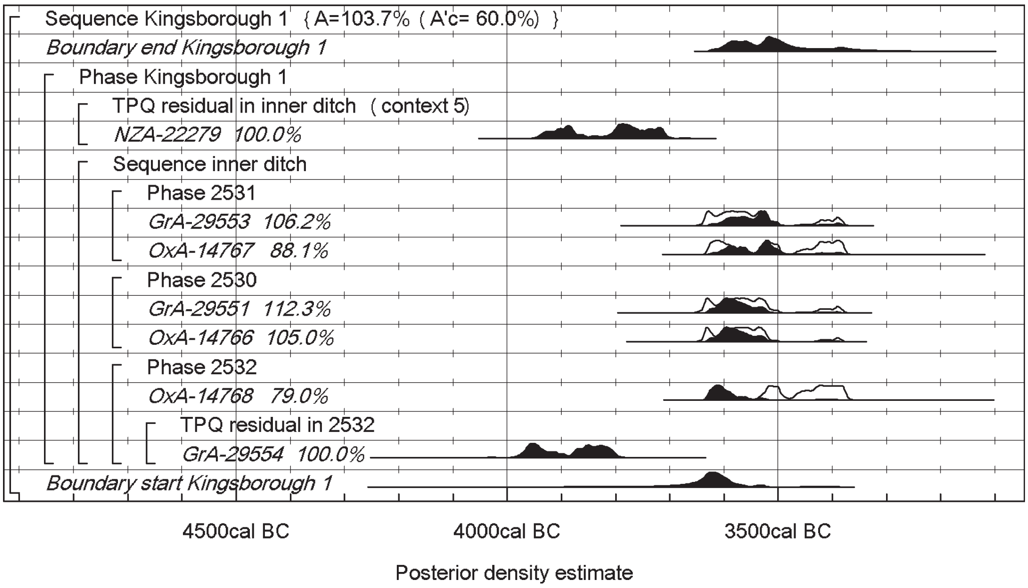


Fig. 7.15. Kingsborough 1. Probability distributions of dates. The format is identical to that of Fig. 7.6. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Neolithic enclosures was scarce, and so simulation models were of limited utility in sample selection. Replicate determinations were obtained from samples from every suitable deposit from the primary fills of each enclosure. All the charcoal or charred plant samples consisted of single fragments of charred plant material and were single entities (Ashmore 1999a), except for NZA-22276 which consisted of ten fragments of charcoal of the same taxon (*Salix/Populus*, possibly but not definitely from the same twig), and OxA-14732, which was carbonised residue from a sherd. It should be noted that at the time of sample selection, the pottery assemblage from Kingsborough 1 was not accessible. It is probable that suitable charred residues may be available for dating from this material. The submission of further samples, from all three ditch circuits, is extremely desirable.

Results and calibration

Fifteen radiocarbon determinations were obtained from the Neolithic enclosures at Kingsborough. The four samples dated by the Rafter Radiocarbon Laboratory were processed as described by Mook and Waterbolk (1985), Beavan and Sparks (1998), and Beavan-Athfield *et al.* (1999), and measured by AMS according to Zondervan *et al.* (2007). The methods used for processing and dating the other samples are described in Chapter 2.6.1. Full details of all the samples and measurements are provided in Table 7.4.

Analysis and interpretation: Kingsborough 1

A chronological model for Kingsborough 1 is shown in Fig. 7.15.

The ditch circuits were far from uniform in profile, and no segment was fully excavated, even though trenches were cut through a number of different segments. Although 'concentrations' of pottery were recovered, the charred remains were recovered from bulk samples. Some of these samples were observed to contain flecks and fragments of charcoal, but no discrete dumps or lenses of charcoal were noted.

The inner ditch circuit is dated by a sequence of six results from caches or concentrations of charred hazelnut shells within the primary fills from a single cutting through ditch 457. Two samples were dated from each of three successive primary fills. These charred remains were described as 'small clusters of charcoal and burnt bits' during the excavation. This section contained numerous sherds of pottery akin to Mildenhall Ware, and the contexts were extensively sampled where they were pottery- or charcoal-rich. The samples indicated that the larger charred elements were predominantly charred hazelnut, rather than charcoal fragments, and thus were interpreted as deposits derived from single events.

Two samples were dated from the basal fill (2532). The results are not statistically consistent (T'=58.7; T'(5%)=3.8; ν=1). The pairs of measurements from the succeeding deposits are, however, consistent (context 2530: T'=0; T'(5%)=3.8; ν=1; context 2531: T'=0.6; T'(5%)= 3.8; ν=1), and five of the six measurements from the primary fills are also consistent (T'=3.2; T'(5%)=9.5; ν=4). The series of results (Table 7.4) suggests, not surprisingly, that the primary infill deposits (contexts 2532, 2530 and 2531,) occurred very rapidly.

One date from these primary deposits (*GrA-29554*) is significantly earlier, suggesting that, contrary to our original interpretation, at least some residual material exists within the concentrations of charred hazelnuts. The presence of charring at this date, *3980–3795 cal BC* (*95% probability*; Fig. 7.15: *GrA-29554*), suggests some activity on the site before the construction of the inner ditch circuit. This sample does not relate to the construction of the inner

Table 7.4. Radiocarbon dates from Kingsborough 1 and 2, Kent. Posterior density estimates derive from the models defined in Figs 7.15 and 7.17.

Laboratory Number	**Sample reference**	**Material**	**Context**	**Radiocarbon Age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Kingsborough 1, inner ditch							
NZA-22279	F2 sect 1 context 6	*Fraxinus* sapwood charcoal	Inner ditch context 5. Primary fill, stratified below context 58. From a concentration of charcoal (> 25 fragments > 4 mm) in primary fill (M. Allen *et al.* 2008, table 3, fig. 4)	5009±35	−25.2	3950–3700	*3945–3830* (*36%*) or *3825–3700* (*59%*)
GrA-29554	46792–2532/1112/A	Charred hazelnut shell fragment	Inner ditch, feature 457. Context 2532. Primary silt on ditch base at outer side. From a concentration of 14 charred hazelnut fragments. Stratified below context 2531(M. Allen *et al.* 2008, table 3, fig. 4)	5110±40	−27.2	3980–3790	*3980–3795*
OxA-14768	46792–2532/1112/B	Charred hazelnut shell fragment	From the same context as GrA-29554	4704±35	−25.2	3640–3370	*3635–3555* (*92%*) or *3540–3520* (*3%*)
GrA-29553	46792–2531/1110/A	Charred hazelnut shell fragment	Inner ditch, feature 457. Context 2531. From a concentration of 30 charred hazelnut fragments, stratified above contexts 2530 and 2532 and below 2528 and 2529, the second of which contained a semi-complete Whitehawk-style Bowl (M. Allen *et al.* 2008, table 3, fig. 4)	4760±40	−23.2	3640–3370	*3630–3495* (*91%*) or *3415–3380* (*4%*)
OxA-14767	46792–2531/1110/B	Charred hazelnut shell fragment	From the same context as GrA-29553	4719±34	−25.2	3640–3370	*3630–3490* (*86%*) or *3435–3375* (*9%*)
GrA-29551	46792–2530/1109/A	Charred hazelnut shell fragment	Inner ditch, feature 457. Context 2530, primary silt against inner edge of ditch. Stratified below context 2531. From a concentration of 28 hazelnut shell fragments (M. Allen *et al.* 2008, table 3, fig. 4)	4770±40	−26.2	3650–3370	*3630–3520*
OxA-14766	46792–2530/1109/B	Charred hazelnut shell fragment	From the same context as GrA-29551	4774±35	−24.1	3650–3380	*3630–3520*
Kingsborough 1, outer ditch							
NZA-22280	64	Charred *Triticum dicoccum/spelta* grain	From context 161 in an upper fill of the outer ditch (M. Allen *et al.* 2008, table 3, fig. 4)	2868±35	−22.3	1190–920	
Kingsborough 2							
GrA-29555	57170–M1248 @ 64cm/A	Pomoideae charcoal	Segment 1, context 6132. From discrete charcoal lens close to base of ditch, recovered from monolith (M. Allen *et al.* 2008, table 3, fig. 6)	4815±45	−25.5	3700–3380	*3660–3525*
OxA-14790	57170–M1248 @ 64cm/A	Pomoideae charcoal	From the same context as GrA-29555	4779±36	−25.4	3650–3380	*3645–3525*

Laboratory Number	**Sample reference**	**Material**	**Context**	**Radiocarbon Age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
GrA-29557	57170–7037 sample 1207/A	Charred *Prunus spinosa* stone	Segment 2, group 6037, context 6081. In subconical heap of animal bone with whetstone on surface of primary fill in ditch butt (did not extend into section). Sample also yielded two emmer glumes and a possible emmer grain (M. Allen *et al.* 2008, table 3, fig. 6)	4780±45	−23.9	3660–3370	*3650–3525*
OxA-14791	57170–7037 sample 1207/B	Charred Rosaceae (cf. *Prunus spinosa*) thorn	From the same context as GrA-29557	4874±36	−25.8	3770–3530	*3700–3630* (*74%*) or *3565–3535* (*21%*)
OxA-14732	57170–6213/B	Carbonised residue from one of four well preserved Neolithic Bowl body sherds from at least two vessels with internal carbonised residue, in this case fresh and abundant	Segment 2, group 6030, context 6213. Silt immediately overlying the ditch base (M. Allen *et al.* 2008, table 3, fig. 6)	4858±34	−24.6	3710–3530	*3695–3630* (*70%*) or *3580–3535* (*25%*)
NZA-22276	Sample 1251	10 fragments *Salix/Populus* charcoal	From the same context as OxA-14732	4794±35	−25.3	3660–3510	*3645–3525*
NZA-22277	Sample 1240	*Sambucus nigra* roundwood or capsule	Segment 1, group 6239, context 6243. Charcoal concentration in top of ditch, associated with amber fragments, probably from a bead (M. Allen *et al.* 2008, table 3, fig. 6)	3069±35	−26.0	1430–1210	

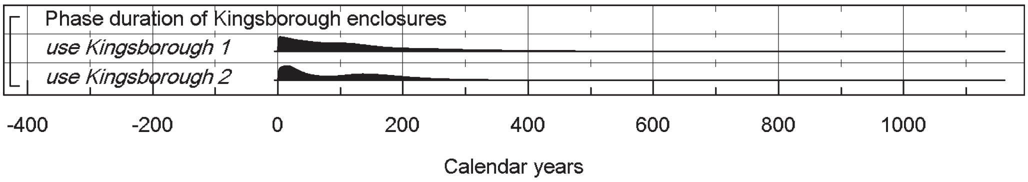


Fig. 7.16. Kingsborough 1 and 2. Probability distributions for the numbers of years during which the enclosures were in primary use, derived from the models shown in Figs 7.15 and 7.17.

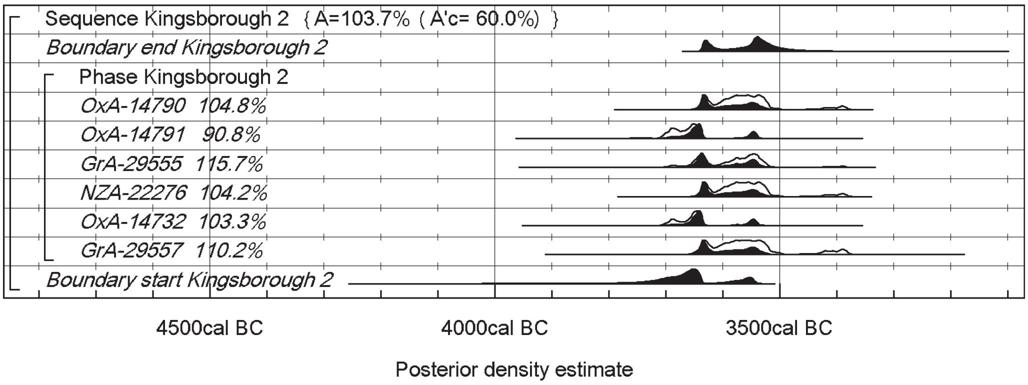


Fig. 7.17. Kingsborough 2. Probability distributions of dates. The format is identical to that of Fig. 7.6. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

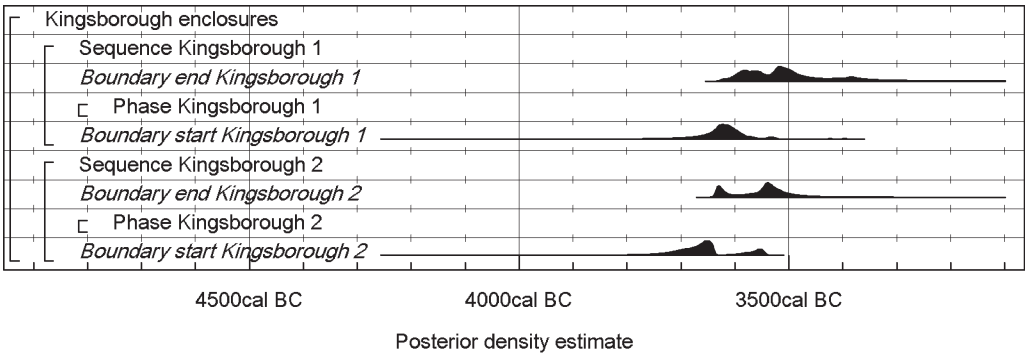


Fig. 7.18. Kingsborough 1 and 2. Probability distributions of key events from the Neolithic enclosures, derived from the models shown in Figs 7.15 and 7.17. The format is identical to that of Fig. 7.6.

ditch, however, and so it is simply used as a *terminus post quem* for context 2532.

Only one sample was dated from a second section through the inner ditch (F2, section 1; NZA-22279; Figs 7.14–15). This was from the primary fill, which occupied nearly two thirds of the ditch and contained 'a lot of charcoal, that might have been dumped' (Luke Barber, pers. comm.). A sample from this context (context 5) contained a relatively large number of charcoal fragments from a wide range of species (R. Gale 2008, 275), which are consistent with the dumping of domestic fuel debris gathered from a wide range of taxa. A sample of *Fraxinus* sapwood was dated. This measurement is significantly earlier than the other five non-residual samples from ditch 457 noted above (T'=51.5; T'(5%)=11.1; ν=5), and is also therefore considered to be residual. It is included in the model as a *terminus post quem* for the end of the primary use of the enclosure.

Finally, a single sample from the outer ditch of Kingsborough 1 has also been dated. This came from a deposit high up in the ditch (F64, slot 2), which contained a charcoal-rich deposit and provides a *terminus ante quem* for the Neolithic enclosure. The date of this sample, 1190–920 cal BC (95% confidence; Table 7.4: NZA-22280), indicates that the ditches were largely infilled by the later Bronze Age.

The chronological model shown in Fig. 7.15 suggests that the inner ditch of the causewayed enclosure was built in *3780–3520 cal BC* (*95% probability*; Fig. 7.15: *start Kingsborough 1*), probably in *3660–3580 cal BC* (*68% probability*). The Neolithic use of the causewayed enclosure ended in *3630–3315 cal BC* (*95% probability*;

Fig. 7.15: *end Kingsborough 1*), probably in *3605–3470 cal BC* (*68% probability*). Overall, Kingsborough 1 was in primary use for *1–395 years* (*95% probability*; Fig. 7.16: *use Kingsborough 1*), probably for *1–150 years* (*68% probability*). These imprecise ranges are a product of the small number of samples dated from this site, but the shape of this probability distribution suggests that a shorter rather than a longer period of use is more probable (Fig. 7.16).

Analysis and interpretation: Kingsborough 2

A model for the chronology of Kingsborough 2 is shown in Fig. 7.17.

A series of six radiocarbon determinations are available from the primary fills of Kingsborough 2 (Table 7.4). Two fragments of short-lived charcoal were dated from a discrete lens of charcoal close to the base of the ditch in segment 1, and pairs of samples from each of two placed deposits within the primary fills of segments 1 and 2 were also dated. All these samples were from the base of the ditch and there are no stratigraphic relationships between them. A single result from the tertiary fills of segment 1 indicates that this ditch was almost wholly infilled by the Middle Bronze Age (95% confidence; 1430–1210 cal BC; Table 7.4: NZA-22277).

This model suggests that Kingsborough 2 was constructed in *3790–3630 cal BC* (*76% probability*; Fig. 7.17: *start Kingsborough 2*) or *3615–3535 cal BC* (*19% probability*), probably in *3710–3635 cal BC* (*61% probability*) or *3565–3545 cal BC* (*7% probability*). The enclosure is estimated to have gone out of primary use in *3645–3435 cal BC* (*95% probability*; Fig. 7.17: *end Kingsborough 2*), probably in *3640–3615 cal BC* (*17% probability*) or *3565–3500 cal BC* (*51% probability*). Overall, primary use of the enclosure spanned *0–315 years* (*95% probability*; Fig. 7.16: *use Kingsborough 2*), probably *0–65 years* (*38% probability*) or *100–185 years* (*30% probability*).

Implications for the site

A summary of the chronologies of the Kingsborough enclosures is provided in Fig. 7.18. They were both probably constructed in the 37th century cal BC or in the first decades of the 36th century cal BC (Fig. 7. 18), Kingsborough 2 being built earlier than its neighbour (*71% probable*). We have only dated the inner circuit of Kingsborough 1, but using other indications elsewhere that inner circuits were the first element of a given layout, it may be that we have at least captured the initiation of that enclosure. Durations are hard to estimate, given the paucity of material from fills above the primary layers of the ditches, although this very absence may reinforce the impression of brevity suggested by the radiocarbon dates (Fig. 7.16). Both enclosures seem to have gone out of primary use in the 36th century cal BC if not before, and it is possible that both were used for only a generation or two. The sections and rapid natural silting observed especially at Kingsborough 2 (Fig. 7.14) may suggest that use-lives were even shorter.

7.5 Chalk Hill, Ramsgate, Thanet, Kent, TR 3635 6535

Location and topography

Chalk Hill is in the western outskirts of Ramsgate, at 30 m OD on the south side of the Isle of Thanet. It lies on a south-facing slope on Upper Chalk cliffs overlooking Pegwell Bay, the present estuary of the river Stour (Oswald *et al*. 2001, fig. 5.20: C) and the English Channel, although it would have been well inland when it was built and used (Figs 7.1–2). The Chalk is locally capped by Brickearth. There may have been more than one enclosure in the immediate area, as at Kingsborough. Some 500 m to the north of the site, an exceptionally large, elongated pit (roughly 3 m by 1.20 m by 1.70 m deep) was found in 1949 during drain digging (Dunning 1966, 8–11; Perkins 2004, 80). An articulated, contracted skeleton, probably male, lay near the base overlain by sherds of a decorated Bowl. At a higher level were the disarticulated bones of another individual, possibly a young adult, separated from the first by a fill which contained charcoal, an oyster shell and flint flakes. The size, shape and contents of the pit are suggestive of a causewayed enclosure segment. Furthermore, segments of a causewayed ditch containing early Neolithic pottery were excavated in 2007 by the Trust for Thanet Archaeology on the other side of a small valley to the east (Lis Dyson, pers. comm.)

History of investigation

Part of what is now recognised as the outer ditch is visible on aerial photographs taken by RCHME in 1989. It was confirmed to be a causewayed enclosure in 1997–8 in the course of an evaluation undertaken by the Canterbury Archaeological Trust in advance of road building for Kent County Council, at which time two further causewayed ditches were discovered (Shand 1998; 2001; Dyson *et al*. 2000). A swathe 25 m to 45 m wide across the enclosure revealed three concentric arcs of causewayed ditch with a maximum dimension of approximately 150 m, as well as internal features (Fig. 7.19). Thirteen segments of the inner ditch, seven of the middle and three of the outer were investigated. All were formed of conjoined pits. Postholes marked possible entrances, especially in the north.

The inner ditch was relatively slight, the segments 0.5 m to 1 m across and seldom more than 0.30 m deep. Because the Chalk is overlain by Brickearths, the ditch fills in general are less chalky than those of some downland enclosures, with consequently variable bone preservation. Finds were fairly scarce in the inner ditch. The middle ditch segments were comparably shallow but rather wider and included concentrations of sherds, but relatively little animal bone. The outer ditch was far more substantial, up to 1.50 m wide and 2 m deep. It was repeatedly recut and reworked, and was far richer in cultural material than the inner and middle ditches and than the subsequent linear ditches (Fig. 7.20). Discrete deposits of cattle remains dominated its faunal assemblage, with smaller quantities of

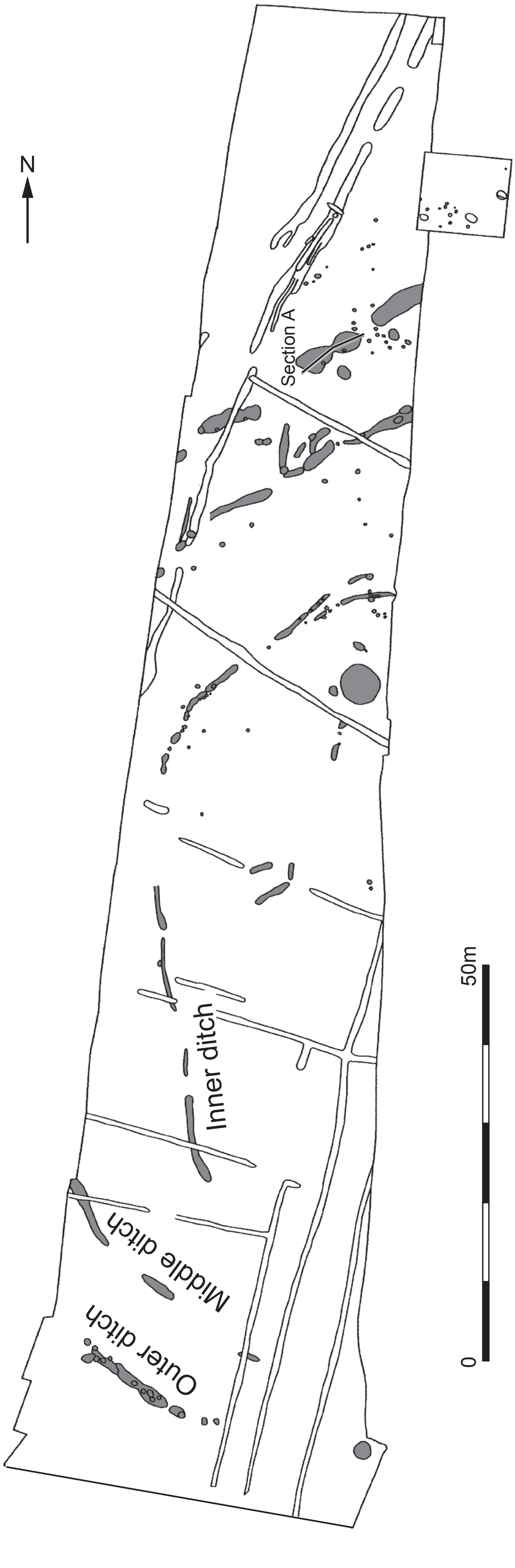


Fig. 7.19. Chalk Hill. Plan of eastern part of excavated area, after Shand (2001, figs 3–4).

caprines and pig. Two largely complete female cattle skulls were placed in isolation in separate pit-like recuts, while eight articulating ankle or 'hock' joints commonly shared space with fragmented pottery and/or fragmented human remains. One pit-like recut contained the disarticulated remains of two caprine skeletons.

Previous dating

No dating had been undertaken at the start of this project, although the Neolithic Bowl assemblage, including fine, burnished, Carinated Bowls with fluted rims and shoulders as well as coarser globular forms (Gibson 2002a), and a flint industry with a substantial blade component (Wilson 2002) combined with the morphology of the site to indicate a date in the earlier fourth millennium cal BC.

Objectives of the dating programme

The three causewayed ditches held out potential for exploring both sequence and duration. The main aims were thus to establish their sequence of construction and absolute chronology; to establish the duration of use of the enclosure, especially for the repeated reworkings of the outer ditch; and to relate the site to other fourth millennium activity in the region.

Sampling strategy and simulation

The first of these aims was frustrated by a dearth of suitable samples from the inner and middle ditches. The outer ditch, however, provided an exceptional sequence of stratified samples, most of them of articulating animal bone, from segments 2 and 3. In both cases the sequences started in the original pits which were later joined to form the longer segments, although there were no samples from their very lowest layers.

Results and calibration

Full details of all the radiocarbon measurements from the site are listed in Table 7.5.

Analysis and interpretation

The model for the chronology of the inner and outer ditch is shown in Fig. 7.21.[1]

The only available sample from *the inner ditch* was carbonised residue from one sherd of a small group clustered with two flint flakes close to one butt of a shallow segment which had only a single fill (Fig. 7.21: *OxA-15391*).

The outer ditch provided 12 samples, extending in both segment 2 and segment 3 from one of the fills of an initial pit to the fill of a late recut.

In segment 2, a lens near the base of one of the initial pits yielded a pig phalanx with a fitting unfused epiphysis, of identical size and development to another phalanx from the same context. The proximity of all three bones

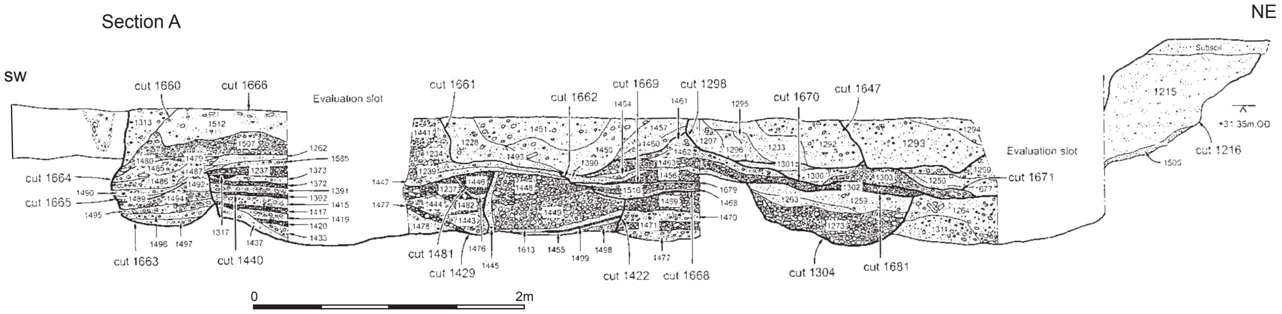


Fig.7.20. Chalk Hill. Longitudinal section of segment 3 of the outer ditch. After Shand (2001, fig. 10).

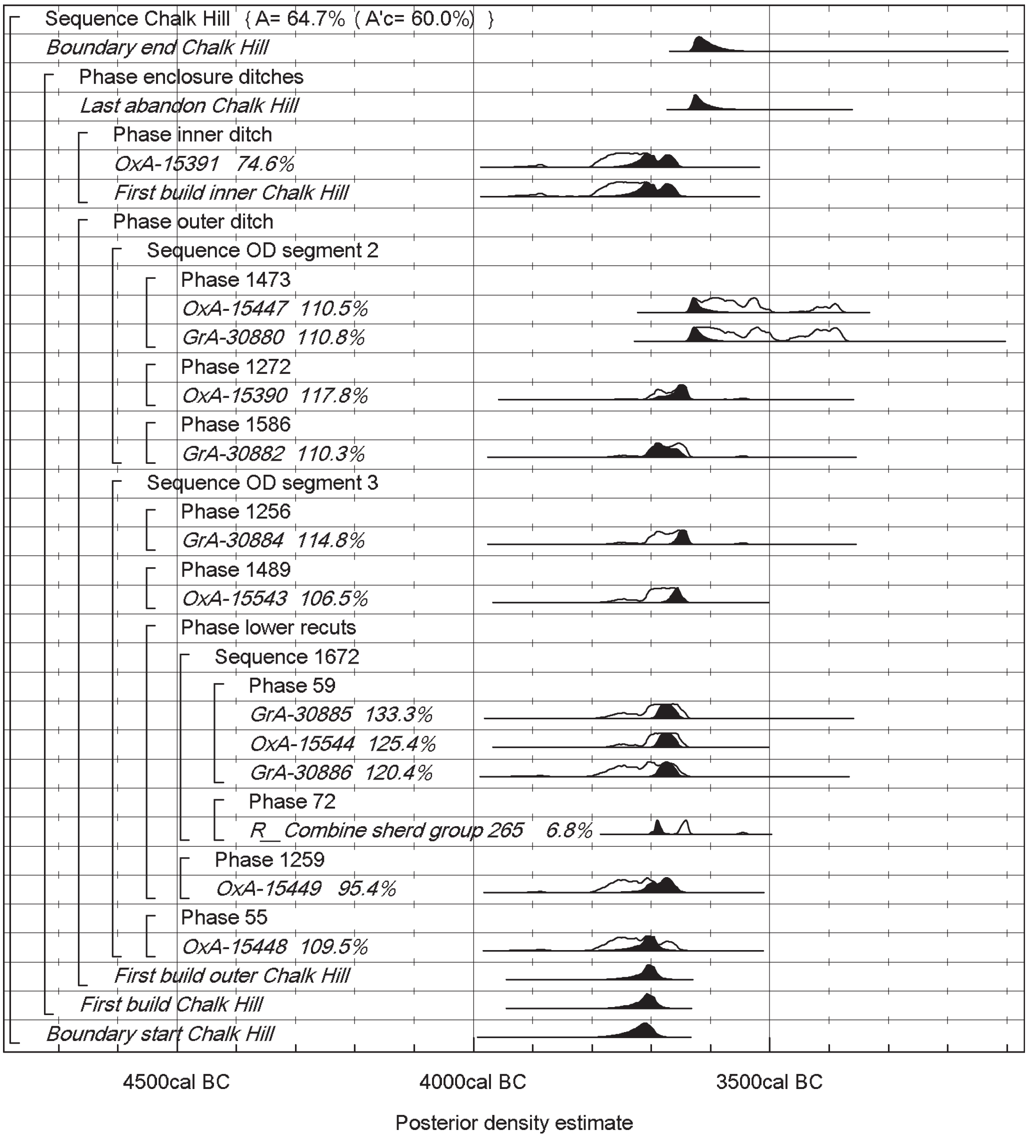


Fig. 7.21. Chalk Hill. Probability distributions of dates. The format is identical to that of Fig. 7.6. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

suggests that they were still, or had until recently been, held together with soft tissue when buried and should hence be close in age to their context. These bones should date from very soon after the pit began to silt (Fig. 7.21: *GrA-30882*). The sequence is completed by a measurement on carbonised residue from one of a group of sherds from a single pot (Fig. 7.21: *OxA-15390*) from a subsequent recut and by measurements on two sheep, many of the bones of which were found together (Fig. 7.21: *GrA-30880, OxA-15447*) from a recut near to the top of the sequence.

Table 7.5. Radiocarbon dates from Chalk Hill, Kent. Posterior density estimates derive from the model defined in Fig. 7.21.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Inner ditch								
OxA-15391	Sherd group 10	Neolithic Bowl sherd approx. 2 cm across with internal residue	Segment 3, F1056, context 1055. The homogeneous fill of a shallow segment (total depth 0.50 to 0.26 m). From a small group of sherds clustered with two flint flakes close to N butt	4968±33	−25.1		3900–3650	*3745–3650*
Outer ditch								
GrA-30882	Articulation 10/A	Pig. Proximal phalanx, of identical size and development stage to another from the same context, probably from the same foot, retaining unfused epiphysis	Segment 2, F1574, context 1586. Fill of one of three primary pits which were later joined into a single segment. Partly overlying pit base, partly overlying initial silts. It would have been deposited soon after the pit was dug	4885±40	−20.59		3750–3630	*3715–3640*
OxA-15390	Sherd group 98	1 large body sherd among >10 from a single Neolithic Bowl. Looks as if further residue has been scraped from others	Segment 2, F1358, context 1272. Lowest fill of recut of segment, stratigraphically later than GrA-30882	4874±33	−27.1		3710–3630	*3690–3635*
OxA-15447	Articulation 37	Sheep. L humerus from among numerous bones from two animals	Segment 2, F1683 context 1473. Lowest fill recut of segment, stratigraphically later than OxA-15390	4750±32	−20.9		3640–3370	*3640–3585*
GrA-30880	Articulation 36	Sheep. L humerus from among numerous bones from two animals	From the same context as OxA-15447	4730±40	−22.39		3640–3370	*3640–3585*
OxA-15448	Articulation 23	Cattle. L astragalus, articulating with tarsal	Segment 3. F56=F1667 context 55=60=1236=1445. Fill of one of primary pits eventually joined to form the segment. This layer, in which there were almost no finds, was separated by *c.* 0.40 m of chalk rubble fill from subsequent recuts. The stratigraphic and probably temporal interval between it and a large amount of fresh, well preserved cattle bone in context 59 at the opposite end of the segment, much of it articulating, makes it most unlikely that articulation 23 came from any of the same animals as the samples from that context, since the context 59 bone seems to have been deposited soon after butchery and/or consumption, without passing through intermediate contexts	4952±33	−21.6		3800–3650	*3755–3675*
OxA-15449	Articulation 9	Cattle. R radius articulating with ulna	Segment 3, F1304, context 1259. Upper fill of an early recut recut of segment	4949±33	−21.8		3800–3650	*3725–3650*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-30888	Sherd group 265/A	One sherd out of >15 from same plain Bowl, 4 of them with fresh, well-preserved residue. Replicate of OxA-15509, -17122	Segment 3, F1672=F44, context 1505=72. One of the fills of an early recut.	4825±50	−30.93	4846±21 T'=0.6; T'(5%)=6.0; ν=2	3710–3510	*3705–3670*
OxA-15509	Sherd group 265/B	Replicate of GrA-30888, OxA-17122	From the same context as GrA-30888	4867±36	−27.3			
OxA-17122	Sherd group 265/B	Replicate of GrA-30888, OxA-15509	From the same context as GrA-30888	4839±31	-27.5			
GrA-30885	Articulation 22	Cattle. R ulna articulating with radius. Radius ?heated	Segment 3, F1672=F44 context 59. Fill of an early recut, stratigraphically later than sherd group 265	4910±40	−22.38		3780–3630	*3695–3650*
GrA-30886	Articulation 20	Cattle. R radius, articulating with ulna. Small patch of burning on ulna	From the same context as GrA-30885	4935±40	−22.34		3800–3640	*3695–3650*
OxA-15544	Articulation 19	Cattle. R radius articulating with ulna	From the same context as GrA-30885	4911±31	−20.5		3770–3640	*3695–3650*
OxA-15543	Articulation 39	Cattle. 1 of 3 fragments of R radius, articulating with ulna	Segment 3, F1665, context 1489. Lowest fill of a recut of segment. Stratigraphically later than GrA-30885, -30886, OxA-15544	4912±31	−21.5		3770–3640	*3675–3640*
GrA-30884	Articulation 6	Cattle. R humerus, articulating with radius and ulna	Segment 3, F1671 context 1256. Fill of a recut of segment. Stratigraphically later than OxA-15543	4885±40	−22.01		3750–3630	*3665–3630*

All four measurements are in good agreement with their stratigraphic positions.

In segment 3 there were several sets of articulating cattle lower limb bones, as if the discard from butchery had been placed in the segment through a substantial part of its infilling. The sequence is anchored by one such sample, from the fill of an initial pit (Fig. 7.21: *OxA-15448*). Stratified above this, there are samples from two separate recuts which truncated the initial pits. In one, there were articulating cattle limb bones (Fig. 7.21: *OxA-15449*). In the other, a sequence is formed by replicate measurements on carbonised residue from one of a group of sherds from the same pot (Fig. 7.21: *sherd group 265*) and articulating cattle bones from three different animals (Fig. 7.21: *GrA-30885–6, OxA-15544*). The three carbonised residue measurements are statistically consistent (T'=0.6; T'(5%)=6.0; ν=2) and have been combined before calibration and included in the model. Two further articulating cattle limb bone samples from successive recuts complete the sequence (Fig. 7.21: *OxA-15543, GrA-30884*). All of these dates have good agreement with the stratigraphic sequence in segment 3, except for the date for *sherd group 265*, which appears to be slightly later than expected. Given the consistency of the measurements on this sample, however, and its clear relationship with three groups of articulating bone from an overlying layer, this date is included in the model.

Measurements on ten of the 12 samples from the outer ditch are statistically consistent, regardless of stratigraphic position (T'=13.3; T'(5%)=16.9; ν=9), which suggests a relatively short period of use. The exceptions are the two sheep from context 1473 in segment 2 (Fig. 7.21: *OxA-15447, GrA-30880*). These are not statistically consistent with the other ten measurements (T'=46.3; T'(5%)=19.7; ν=11) and their context is the latest dated episode in the sequence.

On the basis of this model, the first dated circuit of the enclosure was built in *3780–3680 cal BC* (*95% probability*; Fig. 7.21: *start Chalk Hill*), probably in *3740–3690 cal BC* (*68% probability*). The outer circuit was built in *3760–3675 cal BC* (*95% probability*; Fig. 7.21: *build outer Chalk Hill*), probably in *3720–3685 cal BC* (*68% probability*). Any estimate for the inner circuit is tentative because it is based on a single measurement, although the model suggests that this circuit was built in *3745–3650 cal BC* (*95% probability*; Fig. 7.21: *build inner Chalk Hill*), probably in *3720–3690 cal BC* (*37% probability*) or *3685–3660 cal BC* (*31% probability*).

In segments 2 and 3 of the outer ditch, the stratigraphically latest dated samples were from close to the end of sequences of numerous recuts. The estimate for the end of use of the enclosure based on these samples is therefore close to the age of the final deposits in these segments. The model suggests that the Chalk Hill enclosure was abandoned in *3635–3560 cal BC* (*95% probability*; Fig. 7.21: *end Chalk Hill*), probably in *3630–3595 cal BC* (*68% probability*).

The Chalk Hill enclosure seems to have been in primary use for *45–165 years* (*95% probability*; Fig. 7.22: *use Chalk Hill*), probably for *65–115 years* (*68% probability*).

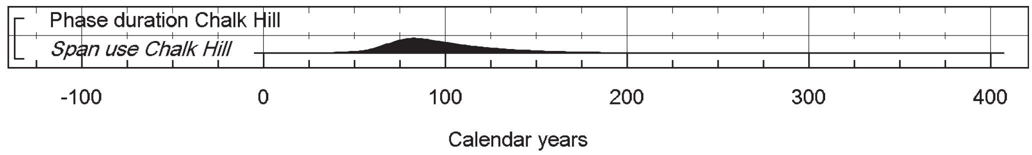


Fig. 7.22. Chalk Hill. Probability distribution of the number of years during which the enclosure was in primary use, derived from the model shown in Fig. 7.21.

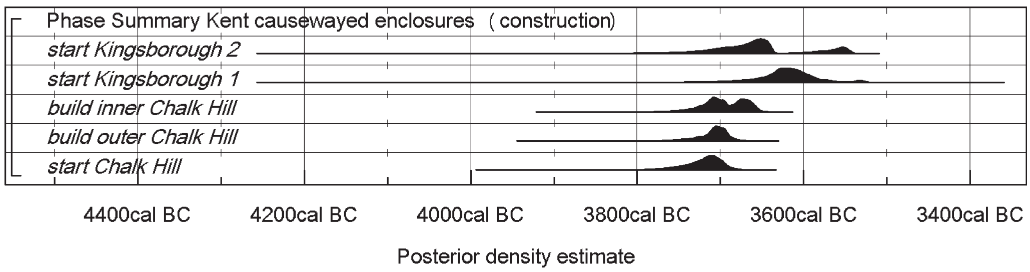


Fig. 7.23. Kent. Posterior density estimates for dates of construction of causewayed enclosures, taken from the models defined in Fig. 7.15 (Kingsborough 1), Fig. 7.17 (Kingsborough 2) and Fig. 7.21 (Chalk Hill). The format is identical to that of Fig. 7.6.

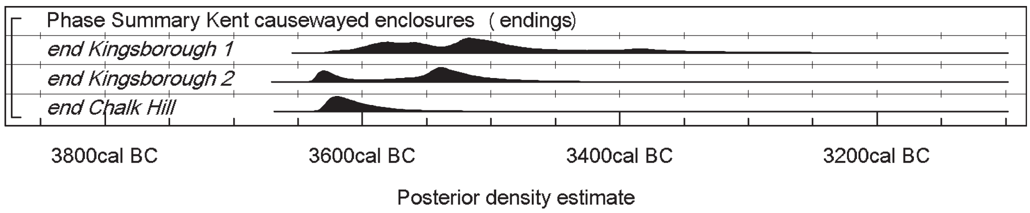


Fig. 7.24. Kent. Posterior density estimates for endings at causewayed enclosures, taken from the models defined in Fig. 7.15 (Kingsborough 1), Fig. 7.17 (Kingsborough 2) and Fig. 7.21 (Chalk Hill). The format is identical to that of Fig. 7.6.

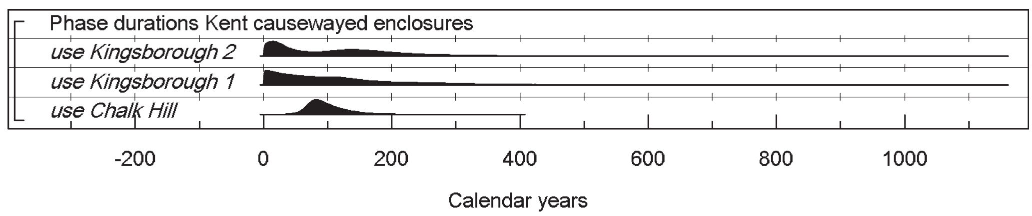


Fig. 7.25. Kent. Probability distributions for the number of years during which the enclosures were in primary use, derived from the models defined in Fig. 7.15 (Kingsborough 1), Fig. 7.17 (Kingsborough 2) and Fig. 7.21 (Chalk Hill).

Implications for the site

The small quantities of Peterborough Ware and Grooved Ware from the site (Gibson 2002) suggest that the original use of the complex was indeed over by the time these traditions became current, having ended at the latest in the 36th century cal BC as indicated by the model, although there was further activity on the site in later periods.

7.6 The Kent side of the Thames estuary

A summary of the chronology for the construction of the causewayed enclosures so far dated from Kent is provided in Fig. 7.23. Chalk Hill was built first (*80% probable*), with its first circuit built in *3780–3680 cal BC* (*95% probability*; Fig. 7.21: *start Chalk Hill*), probably in *3740–3690 cal BC* (*68% probability*). The construction of the enclosures at Kingsborough followed soon after, in the 37th century cal BC. Kingsborough 2 was built before Kingsborough 1 (*71% probable*), and its construction probably fell in the first half of the 37th century cal BC, whereas that of Kingsborough 1 may belong to the latter half of that century or the first decades of the 36th century cal BC.

A summary of the dates when these causewayed enclosures from Kent went out of use is provided in Fig. 7.24. The primary use of Chalk Hill, which is reliably based on a series of determinations on samples through the fill of the outer ditch up to its penultimate recut, ended in *3635–3560 cal BC* (*95% probability*; Fig. 7.21: *end Chalk Hill*), probably in *3630–3595 cal BC* (*68% probability*). The paucity of datable material from the Kingsborough enclosures means that their use-lives are less well known, although it is improbable that either continued in primary use beyond 3500 cal BC.

Chalk Hill is not only the earliest of the dated causewayed

enclosures from Kent, but is also probably the one which was in primary use for longest. It was used for *45–165 years* (*95% probability*; Fig. 7.22: *use Chalk Hill*), probably for *65–115 years* (*68% probability*) – perhaps for three to five generations. Our estimates for the durations of activity at the Kingsborough enclosures are less precise, but each may have been used for under a century, perhaps for only a generation or two, this short use-life supported by the paucity of material and the nature of the fills described above (Fig. 7.25).

Turning to evidence beyond the causewayed enclosures, the fourth millennium cal BC in Kent has been seen as neglected and under-researched (e.g. A. Clarke 1982; M. Barber 1997, 78–9). Long barrows, like other prehistoric earthworks, are scarcer on the North Downs than on the rest of the southern Chalk. There is a small cluster where the Great Stour cuts through the Chalk near Wye. A further dozen possible long barrows or 'mortuary' enclosures have been recognised on aerial photographs (Bewley *et al.* 2004, 72), some of them in other areas, including the Darent valley (which joins the Thames at Dartford) and the downs above Folkestone; others again may once have existed in Thanet (Perkins 2004, 80). West of the Medway, a long barrow or long 'mortuary' enclosure built in an open environment at Tollgate, Gravesham, lies beside a dry valley running from the North Downs to the Thames (Oxford Archaeological Unit 1995; Museum of London Archaeology Service 1999). An unmounded elongated ditched enclosure, excavated by Wessex Archaeology on the chalk at Broadley Road, Northdown, Margate, is of Neolithic aspect: trapezoid in plan with a linear zone defined by beam slots at the centre of its wider end and succeeded by a ring ditch. A charred disarticulated human bone from the beam slots, however, has been dated to the late second or early first millennium cal BC (1270–850 cal BC; 2867±65 BP; NZA-29152; Egging Dinwiddy and Schuster 2009). The enclosure may not have been Neolithic; the bone may have been introduced during the Bronze Age activity which occurred on the site; or the date may be anomalously young because the bone was charred (Chapter 2.6). The last of these seems the most plausible.

The most remarkable feature of the Neolithic archaeology are the two clusters of megalithic monuments built of local sarsen, on either side of the Medway valley where it cuts through the Chalk between Rochester and Maidstone (Drewett *et al*. 1988, fig. 2.1). Recent discoveries have shown that the Medway megaliths stood among other Neolithic structures. The Burham causewayed enclosure overlooks the Medway valley (Oswald *et al*. 2001, fig. 5.20: A) in the vicinity of the eastern cluster of megaliths. A magnetometry survey undertaken by Paul Garwood in 2009 confirmed the presence of inner and outer causewayed ditches, surrounding an area measuring *c.* 220 by 330 m, abutted by a long enclosure or oval barrow and with what appeared to be a large gap on the east side. A single trench across the outer ditch yielded animal bone and early Neolithic artefacts (Paul Garwood, pers. comm.). Investigations in the same area of the Medway valley in advance of the construction of the Channel Tunnel Rail Link have revealed an early fourth millennium cal BC rectangular timber structure near the possible megalith of White Horse Stone. Re-examination of the human remains recovered in 1910 from the Coldrum megalith on the west side of the river has made it possible to date the contents, although not necessarily the construction, of the monument (Wysocki *et al.* in prep.).

Alongside these spectacular developments, settlement evidence still consists largely of artefact scatters and pits, some of the latter with exceptional deposits (M. Barber 1997, 83–4), and all of them discovered by accident. A group of pits at Grovehurst, just across the Swale from Sheppey, stands out for having contained more than half a dozen ground flint axeheads and four whole or fragmentary single-piece flint sickles (Payne 1880; Clark 1932, 72, 76–7, figs 4, 7); the surviving vessel from the site is a fragment from a coarse Bowl with a row of perforations beneath the rim (Piggott 1931, fig. 21). Among these older finds there is the same emphasis on low-lying, now coastal, estuarine or riverine, locations as north of the Thames, whether in Mesolithic and Neolithic scatters at Lower Halstow in the Medway estuary (Burchell 1925), a pit in the valley of the Little Stour at Wingham near Canterbury (Greenfield 1960), a patch of old land surface exposed in Minnis Bay on the Thanet coast (Macpherson-Grant 1969), or, rather later in the fourth millennium, the channel of the Ebbsfleet at Northfleet (Burchell and Piggott 1939). The extent to which settlement traces may survive beneath alluvial deposits along the Thames is emphasised further upstream by a scatter of Mildenhall Ware, struck flint and charred cereals and hazelnuts sealed by later deposits at Manor Way, Woolwich (Sidell and Wilkinson 2004, 67). There has also been a cluster of discoveries on the loessic soils of the coastal Brickearths in the Deal area (Dunning 1966, fig. 8; Holgate 1981, 228–30, fig. 3), undoubtedly in part a product of the working of brick pits.

Radiocarbon dates for early Neolithic activity in Kent are rare. Indeed all but two of the determinations discussed in this section have been obtained in the past few years. At High Rocks, near Tunbridge Wells, the claimed association of a late Mesolithic industry with Ebbsfleet Ware pottery in rock shelters eroded at the base of a sandstone escarpment overlooking a tributary of Medway has been seen as reflecting the presence of pottery-using hunter-gatherers in the Weald (Money 1960; 1962). The excavator himself, however, noted that the largely natural sandy accumulations under the overhangs 'must have been churned up by successive occupations' (Money 1960, 176) and, at site F, from which two fifth millennium cal BC radiocarbon dates were obtained (Table 7.6: BM-40, -91), a few sherds were found even in the lowest layer, below the hearth from which the sample for BM-40 was taken (Money 1960, 190). This, together with the presence of a leaf-shaped arrowhead fragment and a chisel arrowhead among the Mesolithic lithics and a Grooved Ware sherd among the Ebbsfleet Ware, suggest that there may have been even more movement through the sandy deposits than he

Table 7.6. Radiocarbon dates from White Horse Stone Neolithic longhouse; Manor Way, Woolwich; Westwood Cross; Saltwood Tunnel; Little Stock Farm; and High Rocks. Posterior density estimates derive from the model defined in Fig. 7.26.

Laboratory Number	**Sample Reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
White Horse Stone, Kent							
NZA-11463	4818/1	Charred cereal	from fill of posthole 4817 from Neolithic longhouse	4911±60	−23.4	3920–3530	*3935–3870* (*8%*) or *3810–3635* (*87%*)
NZA-11464	4818/2	*Alnus/Corylus* charcoal	from fill of posthole 4817 from Neolithic longhouse	4974±60	−24.1	3950–3640	*3940–3665*
NZA-21770	4818, 291	Calcined animal bone	from fill of posthole 4817 from Neolithic longhouse	5067±30	−24.6	3960–3790	*3955–3790*
NZA-21278	4904	Cow molar	from fill of posthole 4902 from Neolithic longhouse	5028±30	−23.4	3950–3710	*3945–3755* (*90%*) or *3745–3710* (*5%*)
NZA-21769	4821, 377	Calcined animal bone	from fill of posthole 4820 from Neolithic longhouse	4949±30	−17.4	3790–3650	*3800–3660*
NZA-21279	4821, 377	Maloideae charcoal	from fill of posthole 4820 from Neolithic longhouse	5123±30	−25.1	3980–3800	*3980–3910* (*38%*) or *3880–3800* (*57%*)
NZA-21504	5281, 391	Charred *Triticum* sp.	from fill of posthole 5280 from Neolithic longhouse, cut by pit 5256 (Grooved Ware)	5007±75	−26.0	3960–3660	*3960–3690*
KIA-25383	4831, 533	Maloideae charcoal	From hearth 4830 in Neolithic longhouse	5165±31	−25.2	4050–3810	*4040–4015* (*3%*) or *4000–3935* (*62%*) or *3875–3805* (*30%*)
NZA-21506	4876, 289	Charred cereal grain	From Grooved Ware hearth 4874, considered to be residual from the Neolithic longhouse	5039±25	−26.5	3950–3760	*3945–3770*
Manor Way, Woolwich, London							
Beta-153983	Tr 115, sample 25	Charred grains of glume wheat, mainly emmer	A13, Tr 115, −0.40 m OD	4850±100	−25.0 (assumed)	3920–3370	
Westwood Cross, Kent (TR 3630 6760)							
NZA-26510		2 charred emmer grains	Dump of charred cereal grain (7500 grains from 5 litres of sample) in a pit (Peter Clarke pers. comm.)	4591±35	−23.9	3500–3130	
Saltwood Tunnel, Kent (TR 1545 3695)							
NZA-20600		Charred hazelnut shells	Pit SG 175. One of 3 pits containing plain and decorated Bowl pottery of Whitehawk affinities (M. Allen forthcoming)	4742±30	−26.8	3640–3370	
NZA-20599		Charred hazelnut shells	Pit SG 136. One of 3 pits containing plain and decorated Bowl pottery of Whitehawk affinities (M. Allen forthcoming)	4775±30	−24.1	3640–3380	
Little Stock Farm, Kent (TR 0640 3862)							
NZA-19918		Charred hazelnut shells	Pit 2507. Containing Fengate Ware (M. Allen forthcoming)	4482±35	−25.9	3360–3020	
High Rocks, Kent							
BM-40		Charcoal (unidentified). Charcoal from this period on this subsite was identified as *Fraxinus*, *Corylus*, *Quercus*, *Pinus*, *Salix* and *Taxus* (Money 1960, 211)	Site F, hearth 5, period II. Largest of 7 hearths at various levels in a sand layer which contained a predominantly Mesolithic flint industry, a leaf arrowhead fragment and sherds of Ebbsfleet Ware, as well as one sherd of Grooved Ware. Stratified below sample for BM-91 (Barker and Mackey 1959; 85; Money 1960, 188–94)	5660±150		4860–4160	
BM-91		Charcoal (unidentified). Charcoal from this period on this subsite was identified as *Fraxinus*, *Fagus, Corylus*, *Quercus* and *Taxus* (Money 1960, 211)	Site F, layer 2, period III. Dirty white sand layer overlying context of sample for BM-40 and containing smaller quantities of similar lithics and pottery (Burleigh *et al.* 1976, 16–17; Money 1960, 188–94)	5730±150		4950–4280	

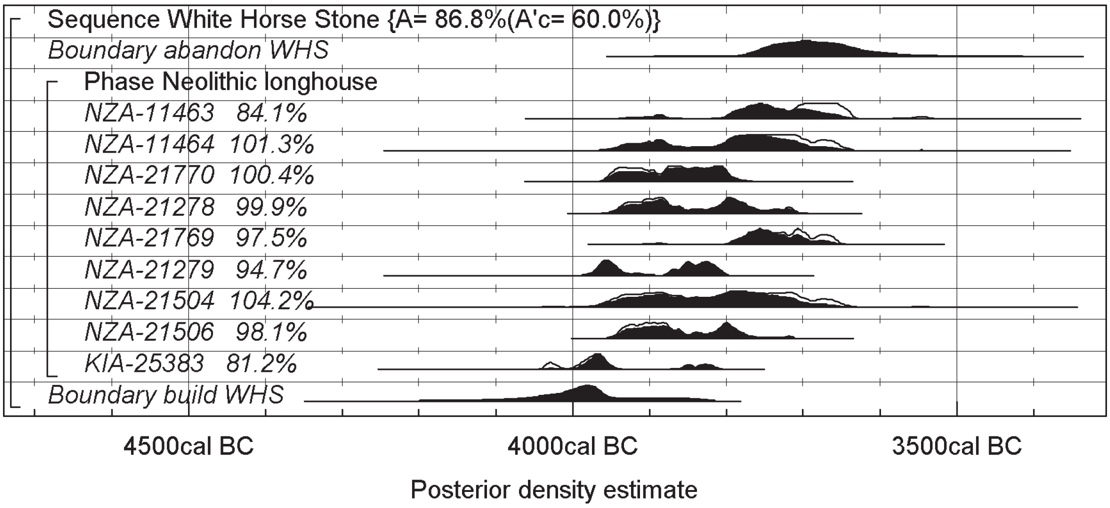


Fig. 7.26. White Horse Stone. Probability distributions of dates from the Neolithic longhouse. The format is identical to that of Fig. 7.6. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

envisaged and that the collection was a mixed one. Both dates were measured on unidentified bulk charcoal samples from deposits where oak charcoal was present, making them *termini post quos* for their contexts. There are three thermoluminescence dates on Ebbsfleet Ware sherds from the site. One, of 5274±375 BP, was measured at an unknown date before 1980 (OxL-61a; H. Green 1980, 196). Two more were measured in 1997, at the request of Tunbridge Wells Museum. The results, of 4700±350 BP (2700±350 BC; OxL-301a) and 4420±490 BP (2420±490 BC; OxL-301a2), contribute to the impression that there was an admixture of Mesolithic and Neolithic material at the site, especially as the two sherds which served as samples in 1997 came from the layer which contained the hearth dated by BM-40 (site F, subsite c, layer 3; Money 1960, figs 11, 12). The only reservation is that the background soil samples, while they were at most 4 m distant from sherds, seem to have come from the layer immediately underlying layer 3.[2]

Cereals from Manor Way, Woolwich, have been dated to 3920–3370 cal BC (95% confidence; Table 7.6: Beta-153983). Their relationship to the rest of the occupation evidence has yet to be fully published. Charred emmer from a grain deposit in a pit at Westwood Cross, 3 km north of the Chalk Hill enclosure, is dated to 3500–3130 cal BC (95% confidence; Table 7.6: NZA-26510). Investigations in advance of the building of the Channel Tunnel Rail Link have revealed traces of early to middle Neolithic activity at several sites, most of them, perhaps significantly, in the south-eastern part of the route, between the Medway Gap and the outskirts of Folkestone, where the route runs below the North Downs along the edge of the Weald. The main discovery here is the White Horse Stone house, discussed below. In addition, five sites on the Greensand in this part of the route yielded Bowl pottery and definite or possible Peterborough Ware, and a sixth Peterborough Ware alone, sometimes from pits. Charred hazelnut shells from pits containing pottery of Whitehawk affinities at Saltwood Tunnel, near Folkestone, are dated to the mid-fourth millennium cal BC (Table 7.6: NZA-20599, -20600) and others from a pit containing Fengate Ware at Little Stock Farm, farther to the west, are dated to the late fourth millennium (Table 7.6: NZA-19918; Barclay and Edwards forthcoming). Settlement with an abundant spread of Fengate Ware had already been identified in the 1960s in the north of the county, preserved beneath colluvium at Baston Manor, Hayes (Philp 1973, 5–19).

White Horse Stone

In 1997–8 excavations in advance of the Channel Tunnel Rail Link at White Horse Stone, Kent (TQ 735 601), revealed the remains of an early Neolithic longhouse measuring approximately 18 m by 8 m (Oxford Archaeological Unit 2000; Bewley *et al.* 2004, fig. 7.2; C. Hayden forthcoming). The site lies at the foot of the escarpment of the North Downs, on the east side of the Medway gap (Fig. 7.1). The building was sealed under a later prehistoric palaeosol, and a small quantity of plain Bowl pottery (a simple, squared, rim and one angular shoulder: suggestive of Carinated style but in too small a quantity to be sure) was recovered from its postholes (Alistair Barclay, pers. comm.); Grooved Ware was also recovered from features in the immediate vicinity. Less well preserved traces of what may have been a second, similar structure were found less than 500 m to the south-east (C. Hayden forthcoming).[3]

Nine radiocarbon measurements have been obtained on material believed to have been discarded during the use of the structure (Table 7.6; M. Allen *et al.* 2005). Seven of the samples came from the fills of postholes, and have been interpreted by us as entering their final contexts following the consolidation of the posts during the use of the structure (Reynolds 1995). Two samples came from hearths within the building. One of these hearths is believed to be of Grooved Ware date on the basis of ceramic associations (49 sherds weighing 178 g), although the dated cereal from it seems to be derived from the preceding longhouse (NZA-

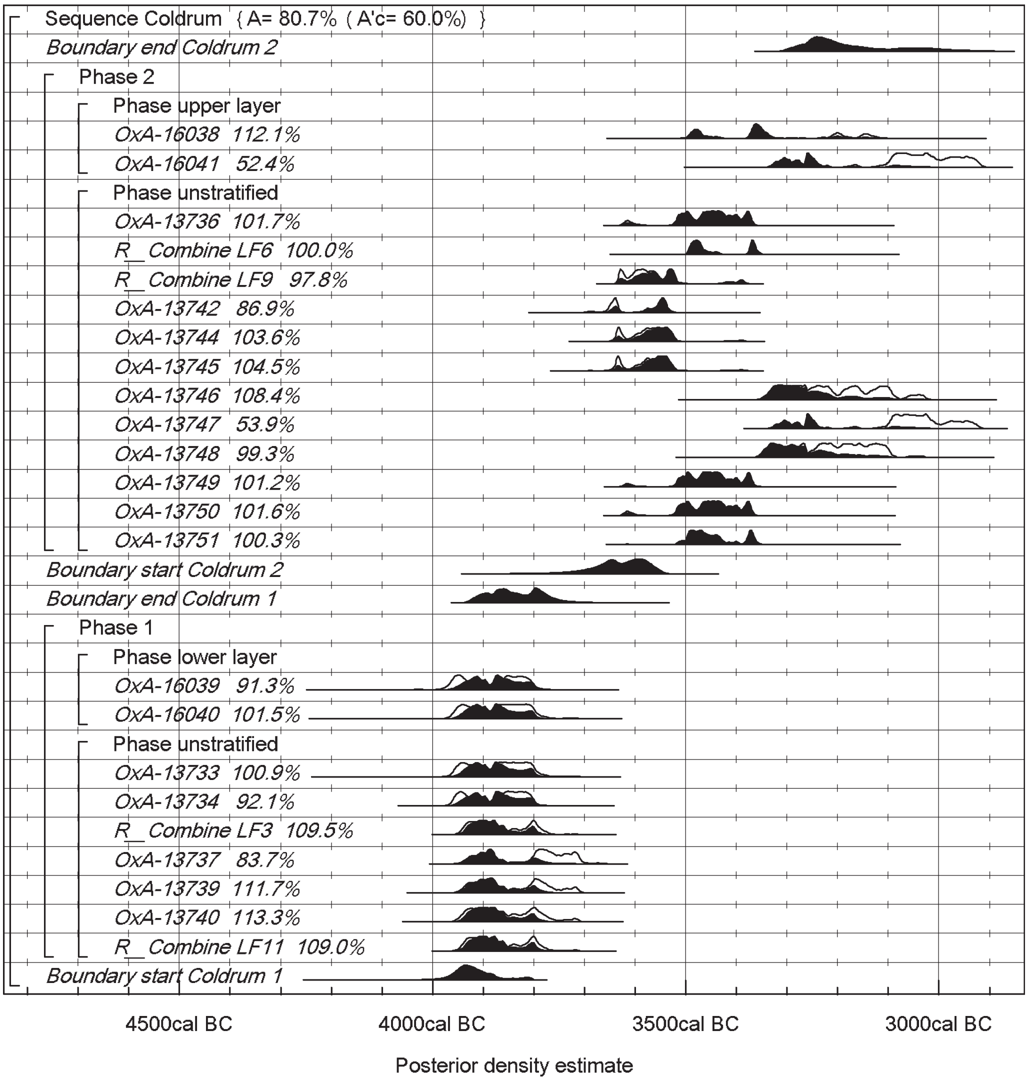


Fig. 7.27. Coldrum. Probability distributions of dates. The format is identical to that of Fig. 7.6. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

21506). Whatever the taphonomy of this cereal sample, its date is clear evidence of early Neolithic activity. The second hearth, lying squarely in the centre of the longhouse, is dated by a sample of short-life Maloideae charcoal (KIA-25383). A scrap of Grooved Ware was found in this hearth, weighing 2 g. We interpret this as intrusive into an earlier feature, given the abundance of Grooved Ware pottery from the site.

The nine measurements from the building are not statistically consistent (T'=39.4; T'(5%)=15.5; ν=8), suggesting that it was used for some time. The model suggests that it was constructed in *4115–3825 cal BC* (*95% probability*; Fig. 7.26: *build WHS*), probably in *4065–3940 cal BC* (*68% probability*), and that it was abandoned in *3785–3530 cal BC* (*95% probability*; Fig. 7.26: *abandon WHS*), probably in *3745–3635 cal BC* (*68% probability*). It seems to have been used for several hundreds of years.

What should we make of this estimate of the duration of the White Horse Stone structure? After all, we are accustomed on the one hand to the rather tenuous evidence for perhaps flimsy and transient structures in early Neolithic contexts in southern Britain as a whole, and on the other to the substantial, sometimes almost monumental, character of LBK timber longhouses. The use-lives of these, however, seem often to have been not more than 30 years or so, on the basis of available site chronologies including Bylany and the Aldenhovener Platte (Pavlů 2002; Lüning and Stehli 1994); and well preserved timber structures in the Alpine foreland also often seem to have use-lives in the order of one or two generations (summarised by Whittle 1996; 2003; Menotti 2004). On the other hand, there are timber structures of medieval origin, with earth-fast posts, still standing in southern Britain today, for example at Fyfield, Essex (J. Walker 1999, 27, 37–8). The structure at Yarnton in the upper Thames may have been in use for 200 years or so (Chapter 8); and we must accept that some buildings of the period may have been maintained for generations. It is striking that what appears to be the earliest construction in the region covered in this chapter, and perhaps in southern Britain as a whole (Chapters 14–15) should have been, despite being timber-built, perhaps the longest-lasting.

The chronology of the longhouse at White Horse Stone is

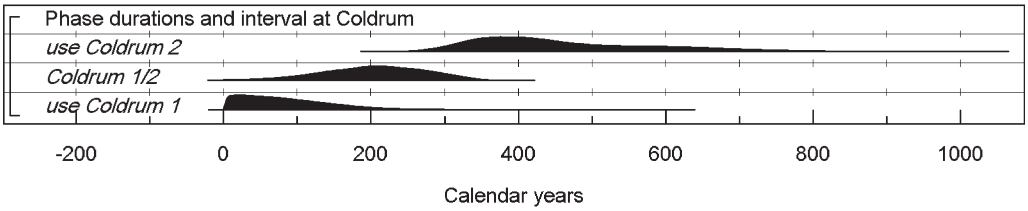


Fig. 7.28. Coldrum. Probability distributions of the number of years during which each of the hypothetical phases of burial occurred and for the gap between the two periods of burial, derived from the model shown in Fig. 7.27.

open to multiple interpretations, since it critically depends on our view of the taphonomies of the dated material (see M. Allen *et al*. 2005; Allen and Hayden forthcoming). For the purposes of this chapter, however, these detailed readings are less vital. Whatever their relationship to the structure, these samples date early Neolithic activity, including three cereal grains.

Coldrum

10 km west of White Horse Stone is the megalithic monument at Coldrum (Fig. 7.1). This consists of a partly ruined rectangular setting of sarsen stones, with a stone chamber set into its eastern side (Bewley *et al.* 2004, fig. 7.3). Nineteenth-century accounts indicate that the chamber was divided into two compartments by one or two orthostats, although these had collapsed or been removed by the early 1890s. Limited excavations of the western half of the chamber in 1910 found human remains stratified in two layers (Bennett 1913; Keith 1913). The upper layer contained three skulls and a very few scattered post-cranial bones. Approximately 1 m below this a substantial assemblage of disarticulated human remains was discovered, with six skulls arranged along the western end of the chamber and two more towards the middle. Concentrations of post-cranial material accompanied each group of skulls.

Twenty-seven radiocarbon determinations are currently available from Coldrum (Table 7.7).[4] These include measurements on femora from all 16 individuals identified in the human bone assemblage by Michael Wysocki, and three measurements on cut-marked bones which may, or may not, represent one or more additional individuals. There is no stratigraphic information available relating to the majority of these remains, but two skulls each can be assigned, on the basis of labeling and records, to both the lower and the upper layers in the chamber.

A model for the chronology of the Coldrum burial deposits is shown in Fig. 7.27. This separates the dates on the human remains into two periods of burial, an earlier phase corresponding to the lower layer and a later phase corresponding to the upper. Measurements from nine samples are included in the first phase of activity. These measurements are statistically consistent (T'=6.6; T'(5%)=15.5; ν=8), suggesting a relatively short period of deposition. This group contains the two skulls dated from the lower layer (*OxA-16039–40*). The later phase of burial is less homogenous and either continued for a longer time or contained a number of episodes of deposition. The two skulls dated from the upper layer are included in this phase (*OxA-16038, -16041*). It should be noted that the majority of the human remains in effect represent an unstratified 'bag of bones' and so we are attempting to reconstruct a plausible model of the chronology of this site from the radiocarbon dates alone, the archaeological information being of limited utility. This is discussed more fully, with alternatives, in Wysocki *et al*. (in prep.) and we present only their preferred model here.

The model suggests that the earlier period began in *3985–3855 cal BC* (*88% probability*; Fig. 7.27: *start Coldrum 1*) or *3850–3800 cal BC* (*7% probability*), probably in *3960–3890 cal BC* (*68% probability*). This phase of burial ended in *3930–3745* (*95% probability*; Fig. 7.27: *end Coldrum 1*), probably in *3905–3825 cal BC* (*46% probability*) or *3810–3775 cal BC* (*22% probability*). It lasted for *1–205 years* (*95% probability*; Fig. 7.28: *use Coldrum 1*), probably for *1–110 years* (*68% probability*).

After an interval of *60–340 years* (*95% probability*; Fig 7.28: *Coldrum 1/2*), probably between *140–285 years* (*68% probability*), further human remains were placed in the stone chamber. This new phase of burial began in *3730–3545 cal BC* (*95% probability*; Fig. 7.27: *start Coldrum 2*), probably in *3665–3565 cal BC* (*68% probability*), and ended in *3305–2960 cal BC* (*95% probability*; Fig. 7.27: *end Coldrum 2*), probably in *3295–3135 cal BC* (*68% probability*). This renewed use of the chamber lasted for *275–720 years* (*95% probability*; Fig. 7.28: *use Coldrum 2*), probably for *300–525 years* (*68% probability*).

The relatively short period during which the individuals which we have assigned to Coldrum 1 met their deaths is striking. It is also clearly separated from the time when the other individuals who were placed in the monument died. At least two of the individuals from Coldrum 1 were found in the lower stratified layer. In combination, these features strongly suggest that the results from our Coldrum 1 group date at least the stone chamber – if not all the monument – at Coldrum as well as the human remains. They also suggest that, as a group, these individuals came to be buried in the stone chamber at Coldrum relatively soon after their deaths; there is thus no clear indication that the remains in question are 'ancestral', having been gathered over a period of time and kept elsewhere before deposition in the monument. Other scenarios, which seem to involve more special pleading, are explored by Wysocki *et al*. (in prep.).

Table 7.7. Radiocarbon dates from Coldrum megalithic tomb, Kent. Posterior density estimates derive from the model defined in Fig. 7.27.

Laboratory Number	**Sample Reference**	**Material**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
OxA-13733	LF1	Human bone, left femur	5076±36	−21.1		3960–3780	*3945–3795*
OxA-13734	LF2	Human bone, left femur	5088±31	−20.4		3965–3795	*3950–3795*
OxA-13718	LF3	Human bone, left femur. Replicate of OxA-13735	5089±38	−20.6	5043±24 T'=2.5; T' (5%)=3.8; ν=1	3950–3770	*3945–3790*
OxA-13735	LF3	Replicate of OxA-13718	5012±31	−20.3			
OxA-13736	LF4	Human bone, left femur	4672±31	−21.4		3620–3370	*3525–3365*
OxA-13737	LF5	Human bone, left femur	5006±34	−20.4		3940–3705	*3945–3830* (*78%*) or *3825–3770* (*17%*)
OxA-13719	LF6	Human bone, left femur. Replicate of OxA-13738	4599±38	−21.3	4619±24 T'=0.5; T' (5%)=3.8; ν=1	3500–3360	*3500–3430* (*66%*) or *3380–3350* (*29%*)
OxA-13738	LF6	Replicate of OxA-13737	4632±30	−21.0			
OxA-13739	LF7	Human bone, left femur	5027±31	−20.5		3945–3710	*3945–3780*
OxA-13740	LF8	Human bone, left femur	5041±32	−20.4		3950–3790	*3945–3790*
OxA-13720	LF9	Human bone, left femur. Replicate of OxA-13741	4709±37	−21.0	4757±23 T'=2.7; T' (5%)=3.8; ν=1	3640–3380	*3635–3515* (*90%*) or *3415–3380* (*5%*)
OxA-13741	LF9	Replicate of OxA-13720	4786±29	−20.8			
OxA-13742	LF10	Human bone, left femur	4832±31	−20.9		3655–3535	*3655–3625* (*18%*) or *3590–3520* (*77%*)
OxA-13721	LF11	Human bone, left femur	5000±38	−20.6	5045±24 T'=2.2; T' (5%)=3.8; ν=1	3950–3770	*3945–3790*
OxA-13743	LF11	Human bone, left femur	5072±30	−20.3			
OxA-13744	RF12	Human bone, right femur	4784±31	−20.4		3640–3520	*3640–3515* (*94%*) or *3395–3385* (*1%*)
OxA-13745	RF13	Human bone, right femur	4792±30	−20.6		3640–3520	*3645–3620* (*7%*) or *3610–3515* (*88%*)
OxA-13746	LF14	Human bone, left femur	4483±30	−20.7		3345–3030	*3350–3150* (*92%*) or *3130–3095* (*3%*)
OxA-13747	LF15	Human bone, left femur	4420±31	−21.1		3310–2925	*3335–3215* (*80%*) or *3175–3160* (*1%*) or *3105–3020* (*14%*)
OxA-13748	LF16	Human bone, left femur	4503±31	−20.9		3355–3095	*3360–3145* (*93%*) or *3140–3120* (*2%*)
OxA-13749	CMF1	Human bone, cut-marked femur	4664±30	−20.5		3615–3365	*3520–3365*
OxA-13750	CMF2	Human bone, cut-marked femur	4670±31	−20.7		3620–3365	*3525–3365*
OxA-13751	CMI1	Human bone, cut-marked innominate	4639±30	−20.5		3510–3360	*3520–3395* (*77%*) or *3385–3355* (*18%*)
OxA-16038		Human skull, from upper level	4587±38			3500–3120	*3510–3425* (*34%*) or *3385–3305* (*50%*) or *3240–3175* (*8%*) or *3160–3125* (*3%*)

Laboratory Number	Sample Reference	Material	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-16041		Human skull from upper level	4413±38	−20.6		3330–2910	*3340–3210* (*80%*) or *3185–3155* (*2%*) or *3110–3015* (*13%*)
OxA-16039		Human skull from lower level	5101±39	−20.6		3980–3790	*3950–3795*
OxA-16040		Human skull from lower level	5077±38	−20.7		3970–3770	*3945–3795*

Sequences

The dates for the Coldrum burials, the construction of the White Horse Stone building, the wheat from Woolwich and Westwood Cross, the Saltwood Tunnel pits and the Chalk Hill and Kingsborough enclosures are shown on Fig. 7.29. The structure at White Horse Stone and the initial monument at Coldrum were the first of the constructions to be built, perhaps in the 40th century cal BC (Fig. 7.29). The longhouse at White Horse Stone may have been built within a generation or two of 4000 cal BC (*4065–3940 cal BC*; *68% probability*; Fig. 7.26: *build WHS*), whereas the chamber at Coldrum was probably set up in the second half of the 40th century cal BC (*3960–3890 cal BC*; *68% probability*; Fig. 7.27: *start Coldrum 1*).

There is a substantial interval between this evidence for the first Neolithic in the region and the construction of the first local causewayed enclosure (Fig. 7.29). From *3665–3565 cal BC* (*68% probability*; Fig. 7.27: *start Coldrum 2*), human remains began to be placed into the stone chamber at Coldrum again. This phase of burial continued after all the enclosures in Kent had been abandoned (Figs 7.24 and 7.27).

The building of causewayed enclosures in Kent was preceded by that of a rectangular wooden structure and a monument connected with burial of the dead, and by the use of cereals. We consider other regional sequences further in Chapters 14 and 15. What is striking is that all three classes of structure are amongst the earliest so far considered. The consistency of this pattern raises the question of the area's role as a route into southern Britain for new beliefs and practices.

Finally, it is worth underlining changes in our understanding of some aspects of early Neolithic material culture in Kent. Until the excavation of the Chalk Hill and Kingsborough enclosures, decorated Bowl pottery was rare in the county (A. Clarke 1982). Undecorated Bowl has been found in early fourth millennium contexts at White Horse Stone, and otherwise in pits and in the Chestnuts megalith, with single sherds from Coldrum (Piggott 1954, 269) and two from the Julliberries Grave long barrow (Jessup 1937, 133). Some groups, notably those from Chestnuts (Alexander 1961, fig. 11), Wingham (Greenfield 1960, fig. 3) and pits at St Richard's Road, Deal (Gibson forthcoming), have some or all of the characteristics of potentially early vessels (Cleal 2004): thin walls; fine, hard fabrics; light rims; open forms; carinated profiles (at St Richard's Road); and internal fluting (at Wingham). Given the early dates for White Horse Stone and Coldrum, some of these may form part of the earliest Neolithic presence in south-east England.

7.7 The Thames estuary and beyond

We can now begin to reconsider the estuary as a whole and to look beyond it. The evidence assembled here suggests that causewayed enclosures were built earlier in Kent than in Essex (Fig. 7.30) and than in most of England (Chapter 14). This pattern might be thought of as simply an accident

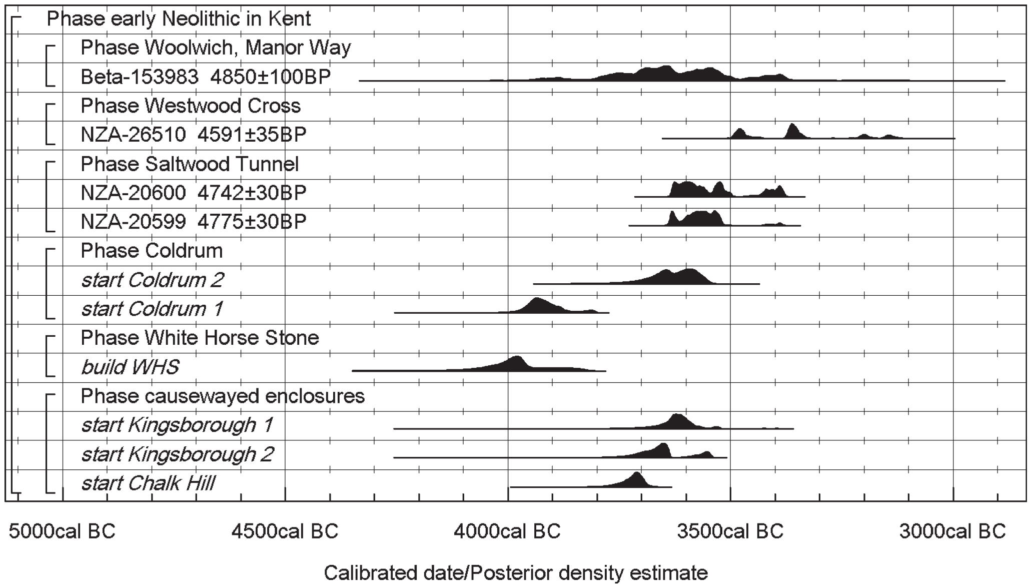


Fig. 7.29. Kent. Posterior density estimates for early Neolithic constructions, taken from the models defined in Fig. 7.15 (Kingsborough 1), Fig. 7.17 (Kingsborough 2), Fig. 7.21 (Chalk Hill), Fig. 7.26 (White Horse Stone) and Fig. 7.27 (Coldrum), and calibrated dates from other sites of the period (Stuiver and Reimer 1993). The format is identical to that of Fig. 7.6.

of research, development and discovery, if the evidence did not extend beyond the enclosures, but there are also early dates for the White Horse Stone timber structure, for one of the Medway monuments and for the burial at Yabsley Street, Blackwall, on the northern side. On the evidence so far available, new things happened early around the estuary.

Whether or not incoming people were involved, new ideas and practices must have been coming from the continent at this time (Whittle and Cummings 2007, *passim*), and to the modern eye it seems to make sense to think of the south-eastern tip of England, with the Thames estuary behind it, as a major landfall. The southern North Sea Basin would have been intimately known to at least some of the people who lived around it, and its changing nature tracked through repeated individual journeys (cf. Coles 1998; Case 1969). Even if our knowledge of latest Mesolithic communities in south-east England as a whole is very poor, there are well documented ones in the Rhine-Maas delta and the freshwater tidal deltas of the Dutch coast (Louwe Kooijmans 2001a; 2001b; Raemakers 1999). People there at times hunted seals, though these may have strayed into the estuaries rather than have been caught on the coast (Louwe Kooijmans 2001b, 217). Interest in coastal resources was continued in the earlier fourth millennium Neolithic settlement at Schipluiden in Delfland, where seals, dolphin and whale remains were all recorded, alongside coastal species of seafish (Louwe Kooijmans and Jongste 2006). We could think of the Greater Thames estuary as a favourable part of the coast to approach, more or less directly over the Straits of Dover from the adjacent Continent, on the one hand because of its then fragmented character, offering multiple landing points (Fig. 7.1), and on the other hand because it provides access to a large hinterland. From this perspective, and based on shortest distances, it might seem plausible for things to have happened early around the Greater Thames estuary.

Was there also any kind of unity of identity around the Thames estuary? Common styles of carinated and decorated Bowl pottery, long-distance exchange of stone axeheads from south-western sources (Clough and Cummins 1988, map 2), and the plans of the respective causewayed enclosures certainly suggest common practices, but are not at all restricted to the estuary alone. Whether there was any further kind of 'estuary identity' is unclear. The enclosures are dispersed, their individual relationships to and use of local coastlines are uncertain, and the uneven preservation of bone makes detailed comparison of patterns of deposition between the enclosures impossible at this stage of research. The social networks engaged at the estuary enclosures may have been every bit as diverse here as elsewhere in southern Britain (Chapters 14 and 15). This may apply also to the period immediately following the *floruit* of causewayed enclosures. Some cursus monuments are known on the Essex side of the estuary, but none are so far known in Kent, or , indeed, in Sussex (Chapter 5). That may reflect only the state of research so far, but aerial photographic cover of Kent has been reasonable (Bewley *et al*. 2004). Perhaps by the time of cursus monuments, the Essex side of the estuary was bound into networks extending into inland eastern England, where linear monuments were much more important (Chapter 6). What took their place on the Kent side?

Timber structures, megalithic monuments and cause-wayed enclosures can all be paralleled in some way or another on the adjacent continent. While substantial timber structures were not common following the demise of the great tradition of LBK and post-LBK longhouses in the middle of the fifth millennium cal BC, some are known in northern France and Belgium in Michelsberg and

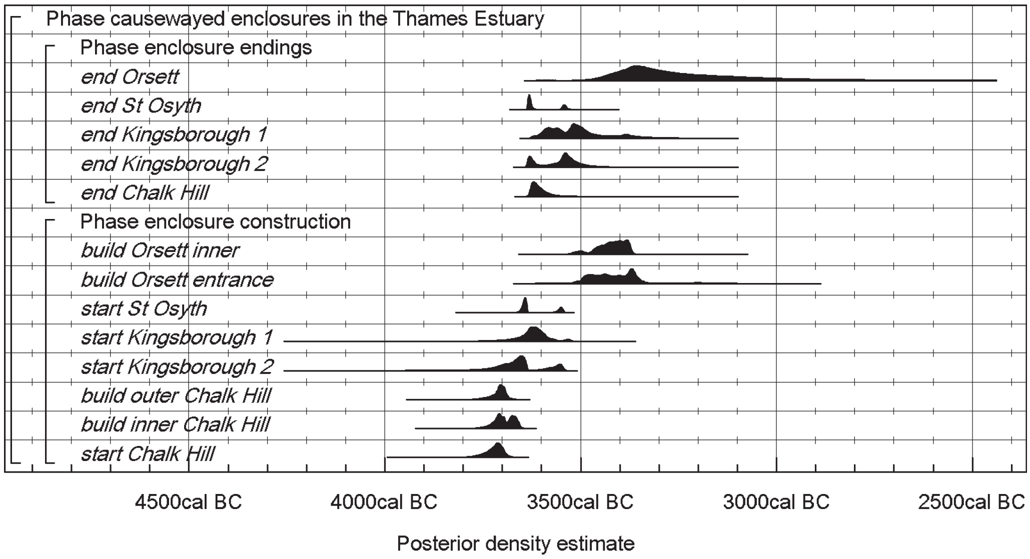


Fig. 7.30. Greater Thames estuary. Posterior density estimates for key events at causewayed enclosures, taken from the models defined in Fig. 7.6 (St Osyth), Fig. 7.10 (Orsett), Fig. 7.15 (Kingsborough 1), Fig. 7.17 (Kingsborough 2) and Fig. 7.21 (Chalk Hill). The format is identical to that of Fig. 7.6.

related contexts (Crombé and Vanmontfort 2007; Sheridan 2007a; Marolle 1998), even though we still need detailed chronologies for them. It has also, of course, been common to refer such southern British structures to the memory of the LBK longhouse tradition (e.g. R. Bradley 2000).

The sheer variety of the Medway megaliths, long commented upon in the literature (e.g. Daniel 1950; Piggott 1935; J.H. Evans 1950; Jessup 1970; Holgate 1981; Ashbee 2005), suggests that they reflect diverse traditions, including continental ones. Affinities have been sought from Brittany to southern Scandinavia, and the Neolithic chronologies of both those areas are compatible with the chronology for Coldrum reported here. The most recently excavated Medway monument, the Chestnuts, Addington, hints at an early date in a different way, perhaps at a history parallel to that of Cotswold long barrows or long cairns like Ascott-under-Wychwood and Hazleton (Chapter 9). The Chestnuts site had been much disturbed in historical times, but some traces of its earlier stages survived (Alexander 1961). It was built within an extensive late Mesolithic lithic scatter, a small fraction of which was recovered from the surviving area of pre-tomb soil. A posthole was sealed beneath that soil. Sherds from eight plain, thin-walled, light-rimmed Bowls from the pre-barrow soil in the forecourt area were interpreted as having been cast out from the chamber, but might also have been *in situ* and part of a pre-monument occupation. Not all the Medway monuments need be of the same date, however, and once a focus in the Medway Gap had been established, others may have been built at different times.

There is a rich tradition of interrupted ditch systems on the adjacent Continent, effectively from central-west France up through northern France and the Rhineland to southern Scandinavia (Burgess *et al*. 1988; Andersen 1997; Varndell and Topping 2002). One or two go back to the Rubané Récent and the Cerny culture, for example in the Aisne valley, and then many more to the northern Chasséen and Michelsberg cultures (see Chapter 15). Again, the chronologies are imprecise (Whittle 2007a), though the Michelsberg culture should date from not later than *c*. 4300 BC (on the basis of connections with the Alpine foreland where dendrochronologies are available). The enclosure at Spiere-de Hel in the middle Scheldt valley appears to be dated to *c*. 4000 cal BC (Vanmontfort *et al*. 2004; Crombé and Vanmontfort 2007). There is thus the possibility of continental antecedents for enclosure construction in the distinctive causewayed style, but again, we need much more precise information about the development of this phenomenon. What is the detailed chronology of interrupted ditch systems in the Paris Basin, Belgium and the middle Rhine? Did these go back to early stages of the Michelsberg culture (and when indeed did that begin? – see Jeunesse *et al*. 2004)? Was this, in Continental terms, a long-lasting, slowly developing, phenomenon, or did such enclosures there also come thick and fast once they began? How did the European and British histories of enclosure building merge? This question is followed much further in Chapter 15.

Finally, some maintain that there were links between some aspects of early southern and eastern British Bowl pottery and that of the Michelsberg culture of northern France, Belgium and the Rhineland. It remains hotly debated whether the connection is direct or generic, and whether it concerns selected items of material culture or whole populations (J. Thomas 1999; Sheridan 2007a; Pailler and Sheridan 2009; Louwe Kooijmans 2007; Whittle 2007a). Alison Sheridan in particular (2007a) has argued for a specific source area for colonising population in northernmost France and Flanders – directly over the Straits of Dover – but there appears to be nothing comparable to the Medway monuments there and little is known of earthen long barrows.

Notes

1 The model presented here is based on an interpretation of the complex stratigraphic sequence of segment 3 current during the assessment phase of the Chalk Hill project (Shand 2001). A revised model, which incorporates an updated interpretation of the sequence and further radiocarbon dates subsequently obtained by the Canterbury Archaeological Trust, will be presented by Bayliss *et al.* (forthcoming c). The posterior density estimates provided by the two models are not substantively different. Segment numbers have altered in the revised version: segment 2 of the outer ditch in this publication has become segment 3, and segment 3 of the same ditch has become segment 5.

2 We are grateful to Jean-Luc Schwenninger of the Oxford University Research Laboratory for Archaeology and the History of Art for this information.

3 We are grateful to Oxford Archaeology and Union Railways Limited for permission to quote these details in advance of publication.

4 These measurements were obtained by Alasdair Whittle and Michael Wysocki during a Leverhulme Trust-funded project to reinvestigate Neolithic human bone in southern Britain. Further radiocarbon measurements were subsequently funded by ORADS, and measured by Seren Griffiths and Tom Higham. The report is in preparation.

8 The Thames valley

Frances Healy, Alasdair Whittle, Alex Bayliss, Gill Hey, Reay Robertson-Mackay, Tim Allen and Steve Ford

The Thames valley, running some 150 km from its headwaters to its estuary, provides us with the longest transect across southern Britain in this project. The valley can be divided into upper, middle and lower parts: respectively from source to the Goring Gap; from there to Teddington Lock, where the river now becomes tidal, although this would have occurred farther downstream in the fourth millennium cal BC, when sea level was lower and the river unembanked (Sidell and Wilkinson 2004, 48; Haughey 2007); and then on downstream. Complex terrace formations vary along the length of the river, bearing a general relation to its broad tripartite division (Bridgland 1994, 19–25, fig. 1.3). The upper Thames is bounded by the chalk of the Downs and the limestone of the Cotswolds (Chapters 3 and 9); the main stream is joined by several tributaries, principally those running south from the Cotswolds. The middle and lower parts are progressively lower-lying; the Kennet joins at Reading, and there are further tributaries, from north and south, on the western side of London (Fig. 8.1). This chapter covers the middle and upper Thames. Three enclosures on the Thames estuary – Orsett on the Essex side, and two at Kingsborough on the Isle of Sheppey – are considered in Chapter 7, and two in the Cotswolds in Chapter 9.

An uneven history of research saw early beginnings in the upper Thames, going back to the work of E.T. Leeds

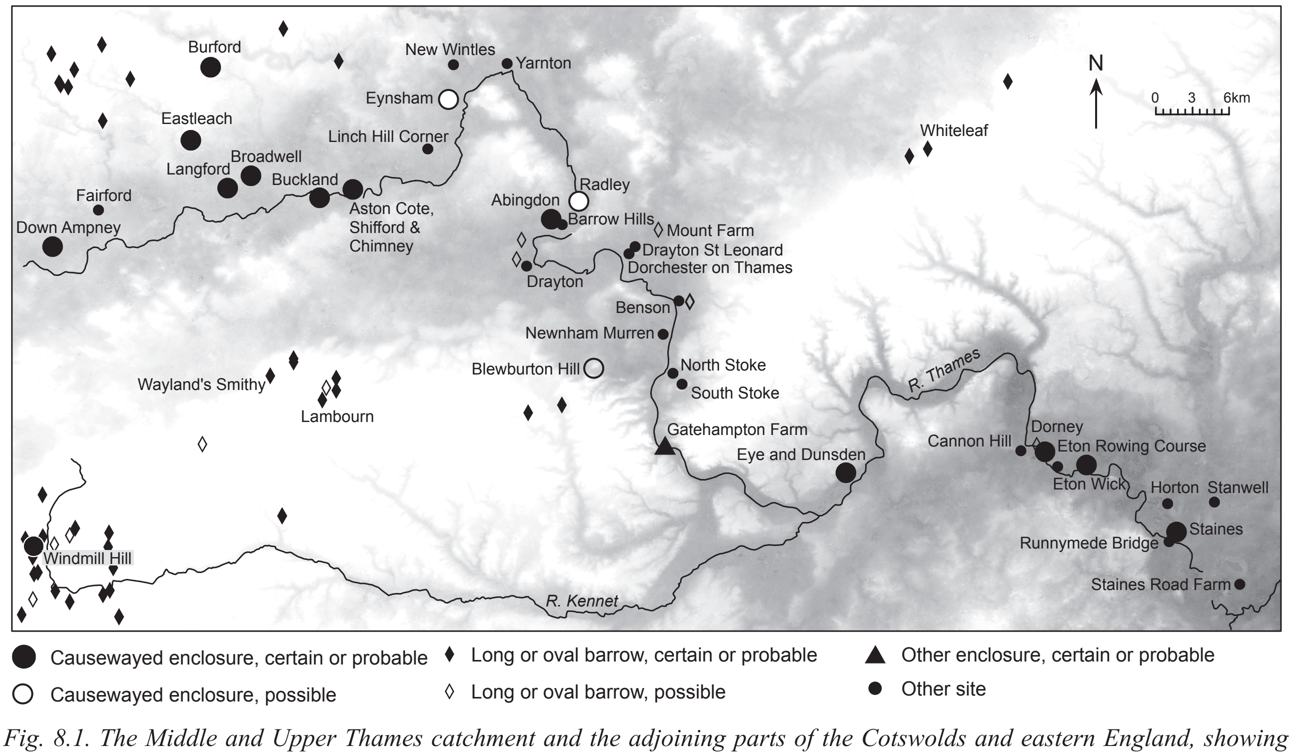


Fig. 8.1. The Middle and Upper Thames catchment and the adjoining parts of the Cotswolds and eastern England, showing causewayed enclosures, long barrows and other sites mentioned in Chapter 8.

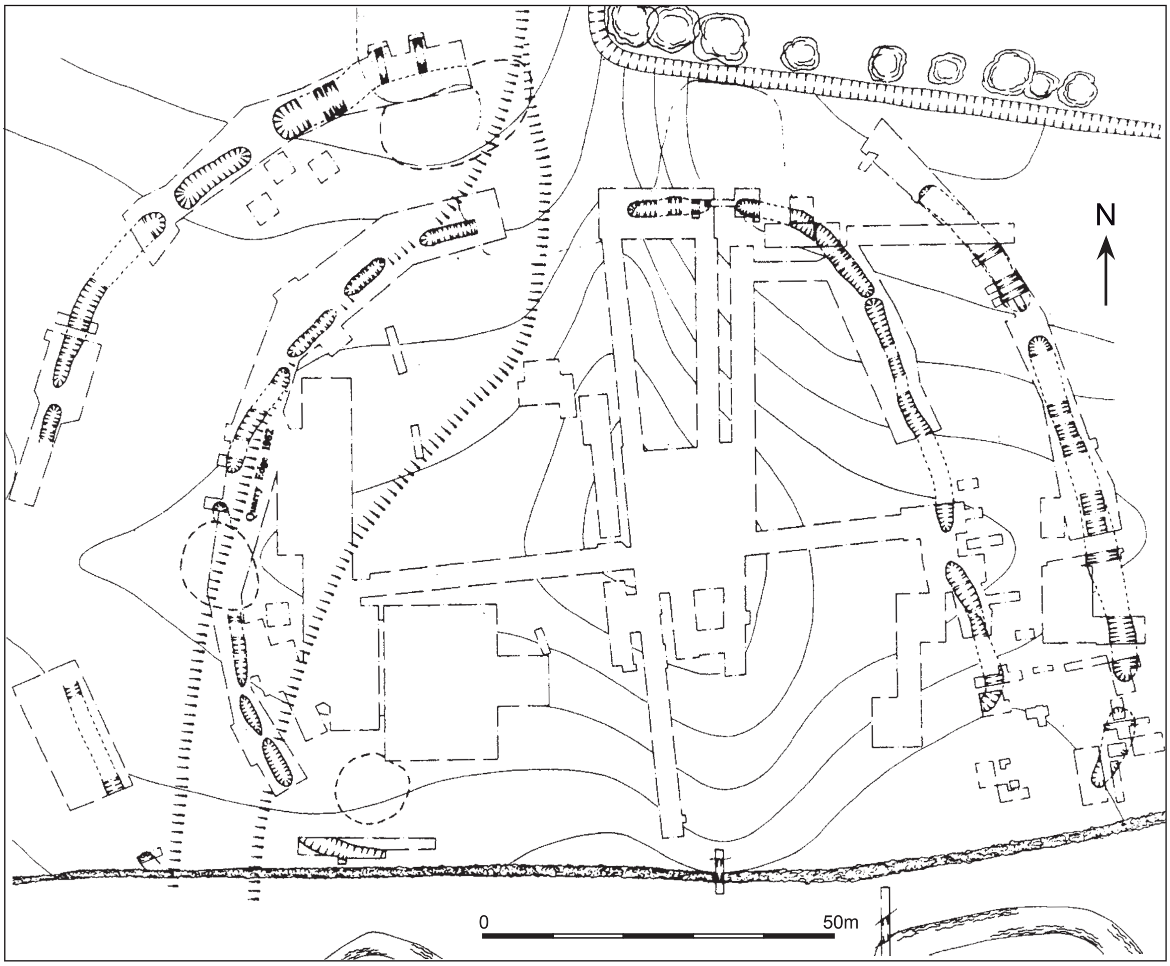


Fig. 8.2. Staines. Plan showing cuttings. After R. Robertson-MacKay (1987, figs 4, 12).

in the 1920s, accelerated research in the London area from the 1970s onwards, and much current activity the length of the valley related to modern development. Investigations have included watching briefs, aerial photography and large-scale excavation in advance of gravel quarrying and development. As a result, 13 causewayed enclosures are known or suspected in the middle and upper Thames catchment downstream of the Cotswolds (Fig. 8.1). The focus of the distribution is the main course of the Thames itself. The certain and probable examples are Staines, Eton Wick and Dorney in the middle Thames; Gatehampton Farm in the Goring Gap, at the meeting of middle and upper Thames; and Abingdon, Aston/Cote/Shifford/Chimney, Buckland, Broadwell, Langford, Eastleach and Down Ampney in the upper Thames. There is a less certain example in the middle Thames, at Eye and Dunsden, and another overlooking the southernmost part of the upper Thames on Blewburton Hill. Examples at Radley and Eynsham also call for confirmation (Oswald *et al*. 2001, 154, fig. 5.1). The circuits of many seem to have incorporated watercourses, whether the Thames itself or smaller streams.

There have been excavations on a large scale at Staines, on a restricted scale at Eton Wick and Gatehampton Farm, and at Abingdon on a selective basis. These four sites form the basis for the dating presented in this chapter. The number of other probable and possible causewayed enclosures shows how much remains to be done in the catchment, especially in its upper part. Continuing research has greatly increased our knowledge of Neolithic settlement up and down the valley, notably recently in the Eton district in the middle Thames, and at Yarnton in the upper (T. Allen *et al*. 2004; Hey 1997; in prep.).

8.1 Yeoveney Lodge Farm, Spelthorpe, Staines, Surrey, TQ 0214 7261

Location and topography

The Staines enclosure lay at 16 m OD among the channels forming the delta of the river Colne, some 1 km from their present junctions with the Thames (Fig. 8.1). It occupied the tip of an elongated gravel island beside one of the channels, its plan flattened on the south-west side, along the watercourse, and on the south-east side (Fig. 8.2; R. Robertson-Mackay 1987, figs 2–4; Oswald *et al*. 2001, figs 3.16–17, 7.5). The coarse gravels were overlain by alluvium, some of which had already been present when segments in the east of the site were first dug (R. Robertson-Mackay 1987, 28). The two circuits enclosed 2.4 ha and

were approximately 25 m apart, the south-western side subsequently eroded by the nearby channel.

The enclosure was 70 km upstream from Orsett and 9 km downstream from Eton Wick. The Stanwell cursus (with its central mound), with a second possible cursus as well as nearby smaller monuments and pit groups, lies 3 km to the north-east (Lewis and Welsh 2004; Framework Archaeology 2006, 28–92). On the opposite bank of Thames is the fourth millennium settlement sealed beneath the first millennium complex at Runnymede Bridge (Needham and Trott 1987; Needham 1991; 2000).

History of investigation

The plough-levelled site was recognised from an aerial photograph in the 1950s. It was excavated in advance of gravel extraction in 1961–3 by Reay Robertson-Mackay for the then Ministry of Works. In the course of this exercise approximately 30% of the inner ditch, 15% of the outer and 30% of the area within the inner ditch were excavated, as well as a smaller area between the two ditches in the south-east (Fig. 8.2). The outer ditch was wider and deeper than the inner (up to 4 m wide by 1.5 m deep below the top of the gravel subsoil versus less than 3 m wide by 1.25 m deep). Silting was mainly natural, although recuts were recognised (R. Robertson-Mackay 1987, figs 7–9). Dense internal features (R. Robertson-Mackay 1987, fig. 12) included Neolithic pits, and much burnt flint, which was scarce in the ditches (R. Robertson-Mackay 1987, fig. 36), as well as pits, burials, palisades and structures of later and unknown periods (R. Robertson-Mackay *et al.* 1981; R. Robertson-Mackay 1987, 41–54; Butcher *et al.* 1987).

Finds were denser in the inner ditch than the outer, but were abundant throughout, with frequent concentrations in segment butts (R. Robertson-Mackay 1987, figs 27–32). 'Separate dumps or accumulations of material were observed in the ditches, of animal bone, pottery and in one instance of burnt flint. These often consisted mainly of one category of material, but not exclusively so' (R. Robertson-Mackay 1987, 34). The fabrics of the large assemblage of Bowl pottery could all have originated from the Thames valley; heavy-rimmed and decorated pots are present and the assemblage, although it has its own characteristics, is broadly comparable with those from Orsett and Abingdon. Although the local gravel flint was frequently worked, Chalk flint was brought to the site, sometimes in nodular or tabular form, as were axeheads of flint otherwise unmatched in the assemblage, single axeheads of groups VI and VII, and modified and unmodified sarsen.

The extent of the excavation has prompted successive spatial interpretations, both in terms of seeing a division of the interior into two distinct halves, similar to that at Etton (Pryor 1998, 377–8), and of a detailed analysis of the use and layout of the site (P. Bradley 2004).

Previous dating

In the late 1960s the National Physical Laboratory attempted to date three bone samples from the site (Table 8.1: NPL-142, -218–19). All three were leached in weak acid before the protein fraction was dated by GPC of carbon dioxide (Callow *et al*. 1963; 1965). NPL-218–19 were also treated with weak sodium hydroxide, producing a 'chocolate brown supernatant liquid' which suggested contamination with humic acids. The low collagen yields and unexpectedly recent results from these samples also caused concern, so much so that a second sample was dated from the outer ditch (NPL-218), and an independent attempt was made to replicate this measurement at the British Museum laboratory. This was unsuccessful as 'only a few grammes of organic residue' remained after pretreatment. Sub-samples of NPL-218–19 were sent for carbon-nitrogen testing, each producing an extremely low value of 0.3% nitrogen (against an expected value of around 4%) and a high C:N ratio of 10 (against an expected value of approximately 2.5). From this the laboratory suggested that the bone collagen had deteriorated and was not suitable for dating purposes. For this reason the three results were not published. The enriched $\delta^{13}C$ values of these bone samples support the suggestion that this material was not suitable for dating (Table 8.1).

In 1983, AERE Harwell made a second attempt to date three bone samples from the fills of the causewayed enclosure ditches. All three failed to produce enough protein for radiocarbon measurements to be undertaken. A third attempt, also on three bone samples from the Neolithic circuits, was made by the British Museum laboratory in 1987. These samples also failed to produce sufficient collagen for dating.

In the mid-1980s, successful measurements were made on charcoal samples from the interior. All of these proved to be of Saxon date, although some were submitted in expectation of Neolithic results (Table 8.1: BM-796, -797; HAR-8439, -9023, -9025–6). Three samples of waterlogged material were also dated in 1982, from the valley of the stream known as the County Ditch, where waterlogged deposits were encountered in a trench cut across and beyond the outer ditch in the south-west of the enclosure (R. Robertson-Mackay 1987, fig. 4), producing dates which fall in the second and first millennia cal BC (Table 8.1; HAR-8440–1, and -9024).

The main chronological inference drawn by the excavator was that the two circuits were probably contemporary because of their closely similar plans (R. Robertson-Mackay 1987, 30).

Objectives of the dating programme

The main aims were to date the two circuits, and to establish their chronological relationship to each other and to local Neolithic activity. A third aim was to estimate the duration of the use of the enclosure.

Sampling

The history of unsuccessful bone dating, the intermittent

Table 8.1 Radiocarbon dates from Staines, Surrey. Posterior density estimates derive from the model defined in Fig. 8.3.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal AD/BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Environmental							
HAR-9024	SEC30B or Staines series 9	Conifer bark	Trench 49. Shell-marl layer in filled-in watercourse in valley of County Ditch, below sample Staines 8	3950±70	−27.4	2630–2200	
HAR-8440	4928A or Staines series 8	Wood	Trench 49. Peaty clay in filled-in watercourse in valley of County Ditch, just overlying sample Staines 9	2260±70	−29.0	410–160	
HAR-8441	ST308	Peat	Trench 49	4150±70	−30.7	2910–2490	
Inner ditch							
NPL-219	Inner ditch	Bulk animal bone, mainly cattle	From the lower silting of the inner ditch, prefix 2, layers 3 and 6. List in archive names following contexts under 'second C14 sample, inner ditch': 2a (xi) (3); 2b (i) A; d (iii) (3); 2a (xi) (3); 2c (xi) (3); 2b (iii) (6); 2a (xii) (3)	2760±130	−26.6		
OxA-15252	STA 2c (xi) (3) [547]	1 of numerous Neolithic Bowl body sherds, some large and well preserved, found together, a few with internal residue, most from same pot	Segment 13–19, trench 17, 2c (xi), L3. In a lower layer of a ditch segment	4364±29	−26.5		
OxA-15253	STA 2c (xv) (3) [546] 97	1 of 44 sherds from a ripple-burnished Neolithic Bowl (R. Robertson-Mackay 1987, fig. 47:P134), all found together, several of them large and well preserved, up to 10 sherds with internal residue. Replicate of GrA-30036	Segment 13–19, trench 18, 2c (xv), L3. In a lower level of the N butt of a ditch segment in a concentration of pottery next to a possible entrance (R. Robertson-Mackay 1987, figs 11, 27	3869±27	−25.5		
GrA-30036	STA 2c (xv) (3) [546] 187	Replicate of OxA-15253	From the same context as OxA-15253	3165±40	−26.1		
GrA-30066	STA 2b (v) (4)	Coarse, plain flint-tempered Neolithic Bowl body sherd with internal residue extracted from among 8 sherds possibly from the same pot	Segment 24–27, trench 26, 2b (v), L4. In a low layer, possibly the bottom layer, of a ditch segment	4650±40	−26.4	3630–3350	*3625–3600 (6%)* or *3525–3380 (89%)*
GrA-30035	STA 2b (iv) (1) or (v) (1)	Coarse Neolithic Bowl body sherd with internal residue	Segment 24–27, trench 26 or 27, 2b (iv), L1 or 2b (v), L1. Sherd is marked '2b (v) (1)', bag is marked '2b (iv) (1). In either case the sherd came from the topmost fill of the ditch in segment 24–27	4705±40	−30.3	3640–3360	*3620–3595 (3%)* or *3525–3365 (92%)*
GrA-30033	STA 2d (iii) (3)	1 of numerous Neolithic Bowl body sherds, many large and well preserved, 11 with some internal residue, from a thick, coarse, flint-tempered vessel	Segment 32–36, trench 33, 2d (iii), L3. In a lower level of a ditch segment. The fact that numerous sherds of the same pot were present in the same context suggests that they were deposited soon after its last use and breakage	4535±40	−30.0		
Outer ditch							
NPL-218	outer ditch	Bulk animal bone sample, mainly cattle	From the lower silting of the outer ditch, prefix 1, layers 3 and 4. List in archive names following contexts under 'second C14 sample, outer ditch': 1b (vi) (3); 1b (i) (4); 1b (iii) (3); 1b (xi) (3); 1b (ii) (3); 1b (i) (4); 1b (vi) (3)	3085±170	−28.1		

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	δ^{13}C (‰)	Calibrated date range (cal AD/BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
NPL-142	1b(ii)4 and 1b(i)4	Cattle bone	Segment 16–21, trenches 16–17, 1b (i) and 1b (ii), layer 4. From the primary silt of the ditch	3460±140	−22.8		
GrA-30197	STA 789, 800	Cattle. Distal end of R metacarpal (789), with unfused epiphysis (800) glued on. 'The alkaline fraction was measured. . . The samples GrA-30176 and GrA-30197 were of a very poor quality bone. . . [they] could be measured, but had a very low organic carbon content so the dates are questionable' (certificate)	Segment 16–21, trench 20, 1b (xi), L3. In a lower layer of a ditch segment	2660±45	−24.8		
GrA-30176	BI ext bone 9 on plan	Cattle. Proximal fragment of R. radius from mature individual, found articulated with ulna. 'The alkaline fraction was measured. . . The samples GrA-30176 and GrA-30197 were of a very poor quality bone. . . [they] could be measured, but had a very low organic carbon content so the dates are questionable' (certificate)	Segment 42–48, trench 44, B (i) ext, layer 6. Just above bottom of segment in layer immediately overlying first quick silting in a cluster of sherds and bone including a human skull ('skull A'; Robertson-Mackay 1987, 36, fig. 10). Planned side-by-side with ulna, both marked '[9]', on original plan of BI ext in NMR (ROBO2), photographed in situ, NMR neg. BB91/8600	3530±60	−28.4		
OxA-15319	YEO61 M (x) (4)	Neolithic Bowl body sherd with surviving residue, among more numerous sherds, inc. at least 1 other with residue	Segment 6–10, trench 8, M (x), L4. In a lower layer of a ditch segment	4735±32	−27.9	3640–3370 cal BC	*3630–3555* (*19%*) or *3540–3495* (*21%*) or *3465–3375* (*55%*)
BM-796		Bulk sample of unidentified charcoal	Segment 13–19, trench 14, 1b (iv), L1. 'A crescent-shaped deposit of charcoal, bone and daub which overlay the outer Neolithic ditch on the northern side of the enclosure (trench 14)' (R. Robertson-Mackay *et al.* 1981, 131)	1130±40		cal AD 770–1000	
Interior							
BM-797		Bulk sample of unidentified charcoal	F32. 'From the upper fill of a pit within the interior of the enclosure (F32), which produced in addition fragments of daub and two sherds of Ipswich-type pottery' (R. Robertson-Mackay *et al.* 1981, 131; R. Robertson-Mackay 1987, fig. 13), cut by context of HAR-9026. Originally 2c Px F2	1050±70		cal AD 780–1160	
HAR-9026	12F33(2)	Bulk sample of unidentified charcoal	F33(2). From gully inside Neolithic enclosure, described in text as Romano-British (R. Robertson-Mackay 1987, 39, fig. 13), cutting context of BM-797	1380±80	−25.6	cal AD 540–780	
HAR-9025	34F154(2)	Bulk charcoal sample, remainder *Betula* sp., *Quercus* sp. and unidentified	F154(2). From lower fill of a posthole originally thought of as probably Neolithic, within the interior of the enclosure. This feature forms one of a complex of eight holes possibly representing a timber structure (R. Robertson-Mackay 1987, fig. 16)	1290±80	−28.0	cal AD 600–940	
HAR-9023	50F142(3)	Bulk charcoal sample, remainder *Betula* sp. and unidentified charcoal	F142(3). From layer 3 in large pit 69 cm deep inside Neolithic enclosure (R. Robertson-Mackay 1987, fig. 16)	1520±70	−25.3	cal AD 390–660	
HAR-8439	16F53	Bulk sample of unidentified charcoal	F53. From a small pit *c.* 25 cm deep within the interior of the enclosure. No other finds were obtained from this feature, which would appear to be associated with a number of other sterile features possibly representing the remains of a timber structure (R. Robertson-Mackay 1987, figs 13, 14)	1440±80	−28.3	cal AD 420–770	

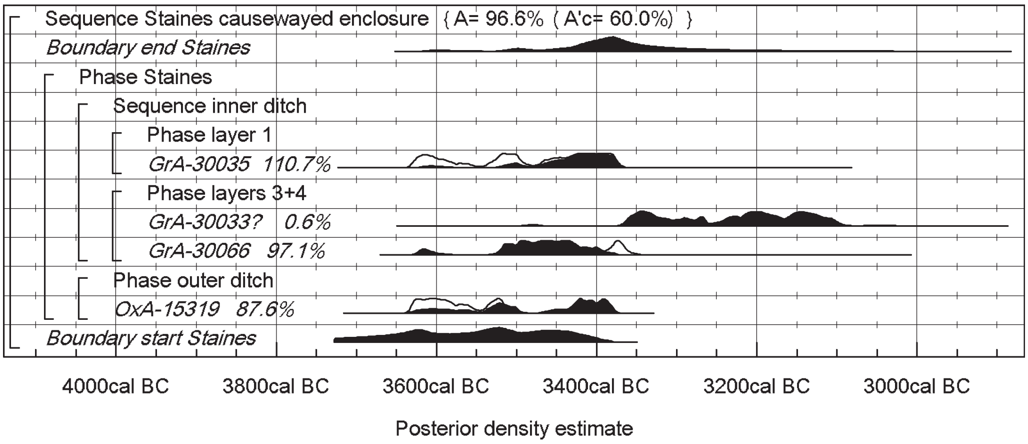


Fig. 8.3. Staines. Probability distributions of dates from the enclosure. Each distribution represents the relative probability that an event occurred at a particular time. For each of the dates two distributions have been plotted, one in outline which is the result produced by the scientific evidence alone, and a solid one which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution 'start Staines' is the estimated date for the start of Neolithic activity on the site. Dates followed by a question mark have been calibrated (Stuiver and Reimer 1993), but not included in the chronological model for reasons explained in the text. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

wetness of the deposits, which would probably not have been conducive to collagen preservation, and the clearly poor condition of the bone from the site all prompted a search for alternative sample materials. This was less than successful because no charcoal from Neolithic contexts could be found, although it had been present in the ditches (e.g. R. Robertson-Mackay 1987, 32), and because most of the pottery had been thoroughly cleaned and substantially represented vessels had been restored, so that the potential for surviving carbonised residues was reduced.

In the event, almost all potentially datable samples from Neolithic contexts in the ditches were submitted for analysis. This posed problems since the records needed to evaluate the precise position of individual contexts in the ditches were not always available. The sometimes numerous ditch layers illustrated and described in the publication were identified during section drawing and do not correspond to the more general layers by which cuttings were excavated and finds recorded. The highest layer number among these is 6, even in the deepest segments of the outer ditch, in contrast to a maximum of 17 in the published sections.

Results and calibration

Full details of all the radiocarbon measurements from the site are listed in Table 8.1. Results relating to later activity are also listed as most of these are otherwise unpublished (but see Hardiman *et al*. 1992, 59; R. Robertson-Mackay *et al*. 1981, 131).

Sixteen samples were submitted as part of this project. Seven articulating or fitting bone samples failed to produce sufficient collagen for dating, and the two bone samples for which results have been quoted produced unreliable dates (Table 8.1: GrA-30197 and -30176). The δ^{13}C values from these bones are anomalously enriched, suggesting that the dated material was contaminated by more recent humic acids from the burial environment. The low carbon content of these samples reported by the laboratory also raises concerns about the validity of these dates.

The remaining seven samples were carbonised residues on pottery. Two results on carbonised residues from sherds of a single decorated Neolithic Bowl (R. Robertson-Mackay 1987, fig. 47: P134) are statistically inconsistent and provide anomalously late dates for this style of vessel (Table 8.1: GrA-30036, OxA-15253; T'=205.4; T'(5%)=3.8; ν=1), as did residue from a plain Bowl sherd from the same segment (Table 8.1: OxA-15252). It appears that the fluctuating water-table at Staines may have, perhaps locally, introduced younger humic material to the charred residues which has not been removed by the laboratory protocols intended to remove such contaminants (R. Hedges *et al*. 1992a). These three measurements have all been excluded from the model, leaving four measurements from the enclosure, all on carbonised residues.

Analysis and interpretation

The model for the chronology of the circuits of the causewayed enclosure at Staines is shown in Fig. 8.3.

The inner ditch. The samples from layers 3 and 4 (Fig. 8.3: GrA-30033, *GrA-30066*) were from different segments, 45 m apart. The two are placed in a single phase because it is impossible to establish the relationship between them. Both would have been in the lower fills of the ditch. The sample from layer 1 (Fig 8.3: *GrA-30035*) was from the same segment as *GrA-30066*, from either the same cutting or an adjacent one, and was certainly stratified above it. If GrA-30033 is included in the model, however, it has poor overall agreement ($A_{overall}$=29.2%). This may suggest that

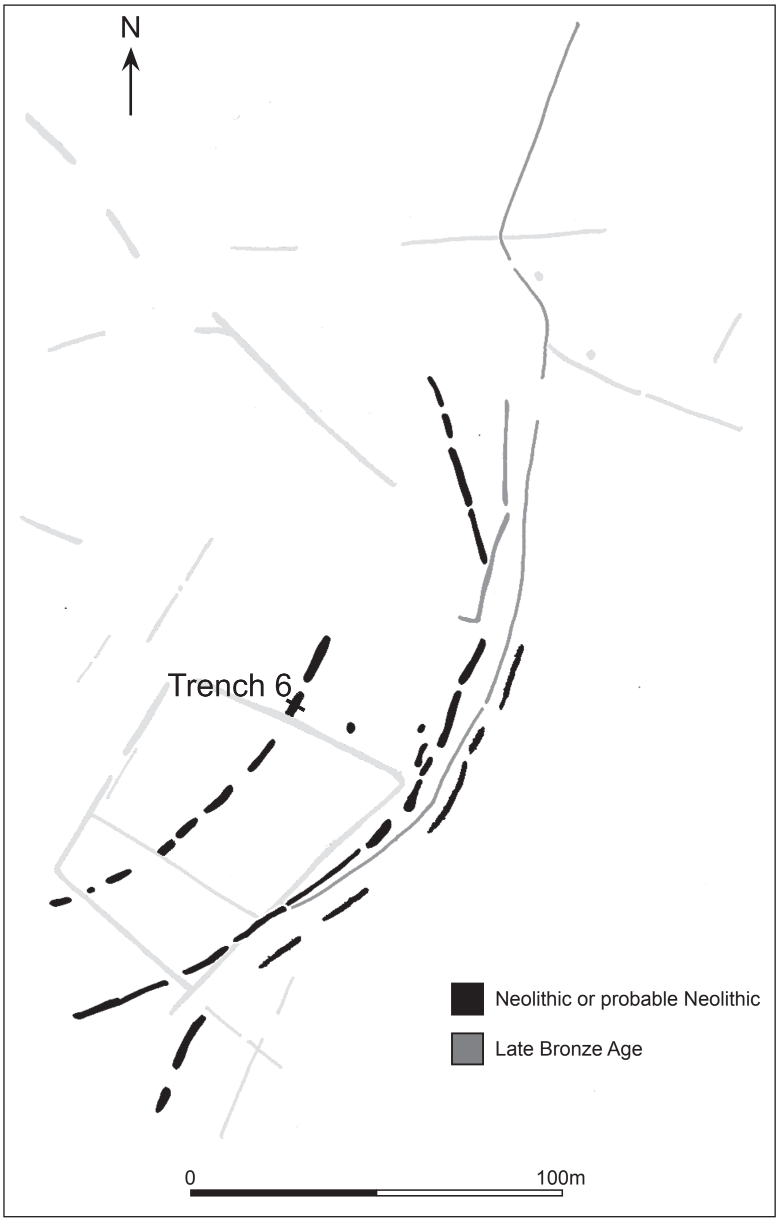


Fig. 8.4. Eton Wick. Air photograph transcription showing location of Ford's trench 6, which was the source of the dated samples. After S. Ford (1993, fig. 1) and Oswald et al. *(2001, fig. 6.4).*

GrA-30033 is too recent for the same reasons of chemical contamination as the measurements on residues that have already been excluded from the analysis.

The lower of the two remaining samples provides a *terminus ante quem* for the construction of the circuit of *3625–3600 cal BC* (*6% probability*; Fig. 8.3: *GrA-30066*) or *3525–3380 cal BC* (*89% probability*), probably of *3520–3425 cal BC* (*68% probability*).

The outer ditch is dated by a single measurement, providing a *terminus ante quem* of *3630–3555 cal BC* (*19% probability*; Fig. 8.3: *OxA-15319*,) or *3540–3495 cal BC* (*21% probability*) or *3465–3375 cal BC* (*55% probability*), probably of *3540–3495 cal BC* (*20% probability*) or *3440–3375 cal BC* (*48% probability*).

The dating of the Staines causewayed enclosure is tentative. It is based on only three measurements on charred residues from a site where the contamination of carbonised residues by more recent substances is demonstrable. The three measurements used in our model, however, are statistically consistent (T'=2.8; T'(5%)=6.0; ν=2), which would be unlikely if the dated material included varying proportions of younger contaminants.

8.2 Eton Wick, Eton, Windsor, Berkshire, SU 9503 7810

Location and topography

The Eton Wick enclosure lies on gravels, at 20 m OD, less than 1 km from the present north bank of the Thames (Fig. 8.1). Air photographs show three concentric arcs of causewayed ditch. A narrow feature between the closely

Table 8.2. Radiocarbon dates from the inner ditch at Eton Wick, Berkshire. Posterior density estimates derive from the model defined in Fig. 8.5.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	δ^{13}C (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
BM-2534	C	Cattle. Vertebrae, horn core and skull	Tr 6 context 18. Black loam with much gravel, overlying organic deposits on ditch base. Stratified below 15 (S. Ford 1993, 31–4, fig. 5)	4680±110	−22.6	3660–3090	*3580–3365*
BM-2535	E	Cattle. Tibia, mandible, phalanx, scapula, tarsal, metatarsal and calcaneum	From the same context as BM-2534	4680±50	−20.3	3640–3350	*3540–3365*
GrA-31370	018 H 1.35, B 1.65, L 1.25	Cattle. Articulating metapodial and proximal phalanx.	From the same context as BM-2534	4900±50	−22.1	3790–3540	*3795–3630* (*93%*) or *3555–3535* (*2%*)
GrA-31534	018 H 1.22, B 1.65, L.1.40	Cattle. Articulated navicular cuboid and proximal metatarsal fragment	From the same context as BM-2534	4600±35	−21.4	3500–3140	*3510–3425* (*93%*) or *3380–3365* (*2%*)
BM-2533	B	Cattle. Metatarsals and humerus	Tr 6 context 15. Dark brown loam with much gravel. (Ford 1993, 31–4, fig. 5)	4750±80	−22.8	3700–3360	*3490–3360*
GrA-31177	015 2, 3 sp 8	Cattle. Metapodial with fitting, unfused epiphyses	From the same context as BM-2533	4630±50	−22.4	3630–3140	*3490–3350*

spaced middle and outer ditches may be a palisade. To the north this follows the line of a tangential ditch with at least one causeway, which joins the middle ditch (Oswald *et al*. 2001, fig. 4.12). No complete circuits are visible, at least partly because of alluvium and later activity (Fig. 8.4). The south-west side may have been formed by a stream which runs directly into the Thames (S. Ford 1993, fig. 1).

Cropmark ring ditches and a double-ditched sub-rectangular enclosure similar to the oval barrow at Barrow Hills (8.4 below) lie to the east (S. Ford 1993, fig. 1). Only 4 km upstream is an uninvestigated cropmark causewayed enclosure at Dorney, also of unknown extent and possibly completed by the Thames (Oswald *et al*. 2001, fig. 6.4). The archaeologically rich alluvium-sealed palaeosol of the Eton Rowing Course (T. Allen *et al*. 2004) lies between the two, in an area where many other Neolithic sites have been excavated, including the Maidenhead Flood Alleviation Scheme, Cippenham (Ford and Taylor 2004), Cannon Hill, Maidenhead (R. Bradley *et al*. 1981), Bray Weir Bank Stud Farm and Bray Marina (Barnes and Cleal 1995).

History of investigation

The inner and middle circuits, the tangential ditch and the possible palisade trench were recognised from air photographs in the 1980s in the course of the East Berkshire Survey (S. Ford 1986). This was followed by geophysical survey to the west of the cropmarks and by the excavation by Steve Ford of trenches across the tangential ditch, the possible palisade trench, a segment butt of the inner ditch, a geophysical anomaly to the west of it and a cropmark enclosure to the east (S. Ford 1993). The tangential ditch and possible palisade trench were almost V-profiled and were of Late Bronze Age date, the trenches to the west and east yielding material of the same period. The inner ditch was of more rounded profile and was rich in fourth millennium cultural material. Dark deposits on the base and sides contained much bone, pottery, lithics and charcoal, as did the apparently naturally silted gravels which covered them. The pottery is broadly similar to that from Staines and Abingdon. Other finds include an antler comb. The middle and outer ditches remain uninvestigated and undated.

Previous dating

Following the excavation, two bulk animal bone samples were dated from a layer immediately overlying the basal deposits in the inner ditch (Table 8.2: BM-2534–5), and a third from a layer higher in the sequence (Table 8.2: BM-2533). These were prepared and measured as described by Ambers *et al*. (1986; 1991). Since all were bulk samples, they may have contained bone of various ages. If none of the bone was redeposited, they indicate a construction date of *3640–3390 cal BC* (*95% probability*; distribution not shown), probably of *3635–3590 cal BC* (*21% probability*) or *3530–3425 cal BC* (*47% probability*).

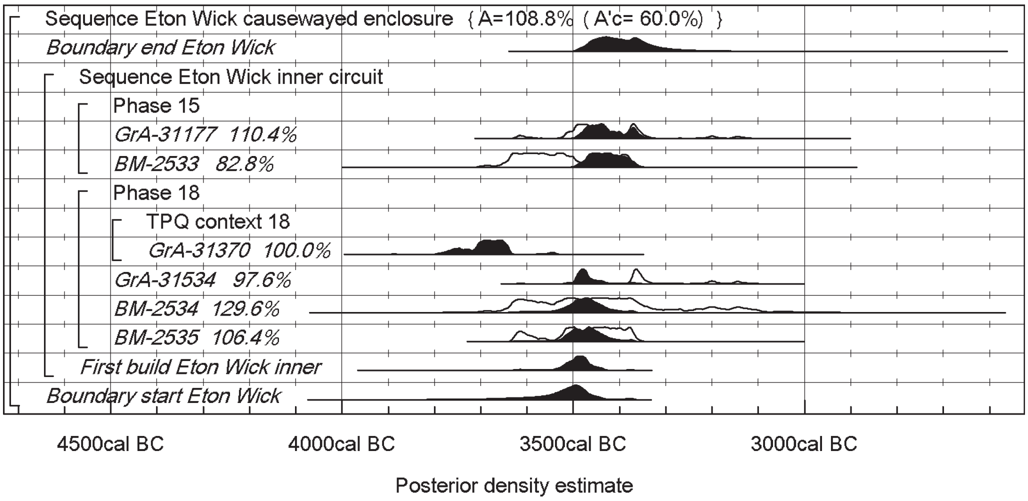


Fig. 8.5. Eton Wick. Probability distributions of dates from the inner ditch. The format is identical to that of Fig. 8.3. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Objectives of the dating programme

It was hoped to refine the existing estimate and to relate the enclosure to occupation on the site of the Eton Rowing Course.

Sampling

Although the inner ditch was rich in finds, only 4 m of it had been excavated. This severely restricted sample availability. No suitable samples could be found from the basal deposits. Two articulating samples (Table 8.2: GrA-31370, -31534) were, however, found from the same context as BM-2534–5 and a fitting sample (Table 8.2: GrA-31177) from the same context as BM-2533.

Results and calibration

Details of all the samples and measurements from Eton Wick are provided in Table 8.2.

Analysis and interpretation

A model for the chronology of the inner ditch of the Eton Wick enclosure is shown in Fig. 8.5.

Stratigraphically, the earliest samples came from context 18. This overlay apparently deliberately placed deposits on the ditch base (Ford 1993, 33–4) and, since the ditch was cut in gravel and is likely to have infilled quickly, context 18 is likely to have silted in soon after construction. The radiocarbon results from this context are not, however, statistically consistent (T'=24.6; T'(5%)=7.8; ν=3). If GrA-31370 is excluded they do form a consistent group (GrA-31534, BM-2534–5; T'=1.9; T'(5%)=6.0; ν=2). Although this sample was articulating, its early date in relation to the others from this context may suggest that it was redeposited and so it is treated as a *terminus post quem* for the overlying layers in the model (Fig. 8.5). The two measurements from the overlying context 15 are statistically consistent (T'=1.6; T'(5%)=3.8; ν=1). On this basis, it is possible to estimate a construction date of *3625–3425 cal BC* (*94% probability*; Fig. 8.5: *build Eton Wick inner*) or *3380−3370 cal BC* (*1% probability*), probably of *3520–3455 cal BC* (*68% probability*).

8.3 Implications for the middle Thames

Causewayed enclosures in the middle Thames lie within a rich and diverse Neolithic landscape (Needham and Trott 1987; J. Lewis 2000; cf. Wilkinson and Sidell 2007). Of note are the midden and occupation deposits that have been revealed on low-lying ground close to the river. A rectangular timber house has recently been excavated at Horton, and will yield radiocarbon dates in due course (Pitts 2008; Alistair Barclay, pers. comm.). On the available evidence, Neolithic occupation sealed beneath alluvium at Runnymede, following activity of later Mesolithic date (Needham and Trott 1987; Needham 1991; 2000), began before the Staines enclosure was built (*more than 99% probable*), and continued through the period of use of that enclosure (Fig. 8.6). This occupation was characterised by timber structures, pits and spreads of cultural material. The rich assemblage of decorated Bowl is stylistically close to the Staines material (Kinnes 1991), with some Ebbsfleet traits in a part of the Runnymede site for which there are no radiocarbon dates (Longworth and Varndell 1996). There is some evidence for interference in the woodland in the fifth millennium cal BC. Pollen dating to the early fourth millennium cal BC indicates some deliberate clearance of the tree canopy, although plant macrofossils continue to show dense alder woodland, presumably from the river margins (Needham 2000, 193–5; Robinson 2000a, 31–2). It is evident from the quantities of dung beetles present that concentrations of large herbivores were maintained in the forest at this time (M. Robinson 1991; 2000a; 2000b). Settlement remains have also been recovered on a less spectacular scale from other riverside and palaeochannel sites in west London (J. Lewis 2000, 68). Of London as a whole, Wilkinson and Sidell (2007, 85) have suggested that

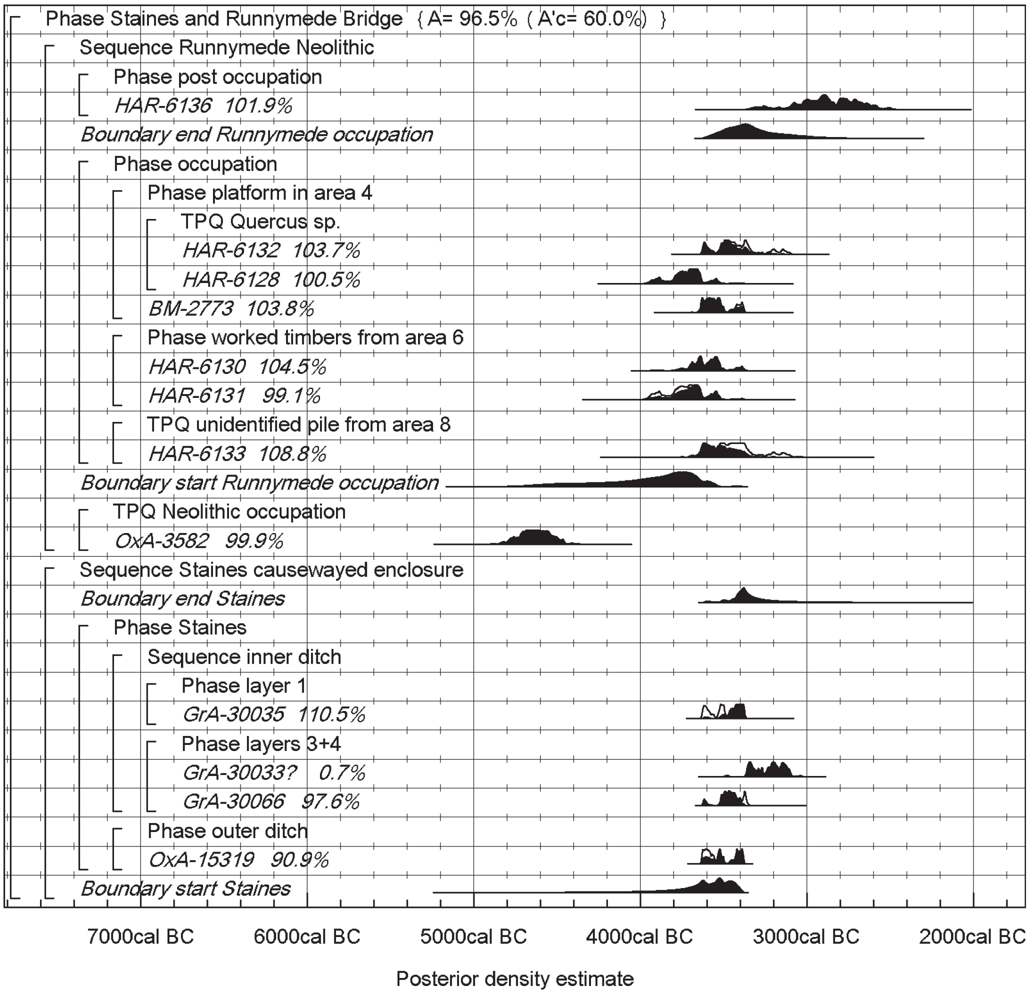


Fig. 8.6. Staines and Runnymede Bridge. Probability distributions of dates from the causewayed enclosure and Neolithic activity. The format is identical to that of Fig. 8.3. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

'large tracts of the lowland areas consisted of uninhabitable marsh, crossed only by occasional creeks'.

A ring ditch at Staines Road Farm, Shepperton, some 6 km south-east of Staines, in which there were a complete and an incomplete inhumation (Bird *et al.* 1990, 211–13; J. Lewis 2000, 69; P. Jones 2008), yielded five statistically consistent measurements, one of them on an articulated sample (T'=5.9, T'(5%)=9.5; ν=4). Two samples came from the primary silt (OxA-4057–8), two from a recut (OxA-4059–60), and one from the complete burial (OxA-4061) which was either cut into the primary fill or lay in the recut. They provide an estimate for construction of *3885–3380 cal BC* (*95% probability*; Fig. 8.7: *start Staines Road Farm*), probably *3690–3495 cal BC* (*61% probability*) or *3480–3445 cal BC* (*7% probability*), a broad range which encompasses the construction and use of the Staines enclosure and the later part of the occupation at Runnymede.

The undated first phase of a similar monument at Horton, less than 5 km north-west of Staines, may be of similar age. This consisted of a U-plan ditch in which some posts had been set and in which clusters of bone, plain Bowl pottery and struck flint had been placed after some silt had accumulated. This was succeeded by a deeper ditch enclosing a larger, oval area, in the waterlogged lower fills of which were placed bark containers, wooden objects and a complete Fengate Ware vessel. Six samples from these primary silts were dated (Table 8.3): three birch bark containers, a piece of roundwood (on which replicate measurements were made), carbonised residue from the interior of the complete pot, and a red deer antler (Ford and Pine 2003). The antler measurement (Fig. 8.7: BM-2754) is significantly more recent than the others (T'=31.8; T'(5%)=11.1; ν=5). Since the ditch base was waterlogged, it is possible that the antler may have suffered the same contamination as bone samples from Staines (although the $\delta^{13}C$ value is within the expected range for antler samples; Table 8.3). It is therefore excluded from the model. The remaining dates provide a construction estimate for the outer ditch of *3790–3030 cal BC* (*95% probability;* Fig. 8.7: *start Horton phase 2*), probably of *3435–3130 cal BC* (*68% probability*). The second phase at Horton was therefore very probably later than the other monuments considered in this section.

The C1 Stanwell cursus, 3 km to the north-east of the

Table 8.3. Radiocarbon dates from Horton; Staines Road Farm, Shepperton; the Neolithic occupation at Runnymede Bridge; and early Neolithic episodes at the Eton Rowing Course. Posterior density estimates derive from the models defined in Figs 8.6–9.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Horton, Berkshire								
OxA-3577	Bowl B1	Birch bark container	208. Base of outer ditch (Ford and Pine 2003)	4390±75	−25.7		3350–2880	*3335–3205* (*27%*) or *3195–2910* (*68%*)
OxA-3008	Bowl B2	Birch bark container	From the same context as OxA-3577	4320±120	−26.0		3360–2580	*3355–2860*
OxA-3576	Bowl B3	Birch bark container	From the same context as OxA-3577	4585±75	−25.8		3630–3030	*3495–3425* (*4%*) or *3385–3015* (*91%*)
OxA-3578		Carbonised residue from complete Fengate Ware vessel	From the same context as OxA-3577	4520±80	−24.6		3500–2920	*3370–3000* (*93%*) or *2990–2955* (*2%*)
BM-2754	Antler 3	Collagen from red deer antler. 'The antler was substantial, and had a high, well preserved collagen content' perhaps 'one of the small percentages of analyses which fall by chance at the limits of the distribution of experimental measurements' (Ambers 2003)	From the same context as OxA-3577	4100±60	−21.2		2880–2470	
BM-2797		Cellulose from waterlogged *Fraxinus* sp. roundwood	From the same context as OxA-3577	4390±100	−25.6	4355±37	3090–2890	*3340–2910*
BM-2816		Repeat of BM-2797	From the same context as OxA-3577	4355±37	−25.3	T′=0.1; T′(5%)=3.8; ν=1)		
Staines Road Farm, Shepperton, Surrey								
OxA-4057	SRFS/RC, 1/G1 E/F	Cattle. Humerus	From primary fill of a ring ditch with plain, open Bowl pottery (Bird *et al.* 1990, 211–13; J. Lewis 2000, 69)	4670±85	−21.0 (assumed)		3650–3120	*3640–3395*
OxA-4058	SRFS 89, 2/G9 E/F	Cattle. Metacarpal	From the same context as OxA-4057	4740±85	−21.0 (assumed)		3700–3350	*3645–3390*
OxA-4059	SRFS 89, 3/G15 D1	Cattle. Metatarsal	From recut of ring ditch, with Peterborough Ware and probably redeposited Bowl pottery	4595±85	−21.0 (assumed)		3630–3020	*3625–3260* (*94%*) or *3215–3190* (*1%*)
OxA-4060	SRFS 89, 4/G13 D2/3	Cattle. Tibia	From the same context as OxA-4059	4860±85	−21.0 (assumed)		3900–3370	*3605–3485* (*41%*) or *3475–3370* (*54%*)
OxA-4061	SRFS 89, 6/G10	Human. Bone from an articulated burial of a 30–40 year-old female	Cut into primary fill of first phase of ring ditch, either cut through or contemporary with second fill	4645±85	−21.0 (assumed)		3640–3100	*3625–3315*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Runnymede Bridge, Surrey								
OxA-3582	ERB89 20.957.7	*Fraxinus* charcoal	Parcel 1C/D. Basal fill of linear ditch underlying Neolithic occupation horizon	5780±85	−24.2		4840–4450	*4835–4450*
HAR-6132	A4 S1(b)	Waterlogged *Quercus* pile	Area 4B. One of many, associated with brushwood raft and Neolithic artefacts (Needham 1991, 28–9, figs 13–15)	4630±70	−27.5		3640–3100	*3640–3325*
HAR-6128	A4 S4 (b)	Waterlogged *Quercus* pile	From a different pile in the same context as HAR-6132	4920±80	−26.8		3950–3530	*3945–3625* (*89%*) or *3585–3530* (*6%*)
BM-2773	ERB78 A4 L3a	Cellulose from waterlogged *Quercus* sp. branch, plus offcuts	From brushwood raft associated with HAR-6128, 6132	4760±50	−21.4		3650–3370	*3650–3495* (*83%*) or *3440–3375* (*12%*)
HAR-6130	A6 F202(a)	Waterlogged *Alnus glutinosa* timber	Area 6. Parcel 2A. Part of water-disturbed structure (Needham 1991, fig. 17)	4830±70	−29.2		3760–3370	*3760–3495* (*90%*) or *3430–3380* (*5%*)
HAR-6131	A6 168(a)	Waterlogged Salicaceae worked timber	From the same context as HAR-6130	4930±90	−25.0		3960–3520	*3940–3855* (*7%*) or *3850–3515* (*88%*)
HAR-6133	A8 3b(a)	Tip of waterlogged pile	Area 8. One of a group of three piles (Needham 1991, 27, fig. 12)	4690±110	−26.9		3700–3090	*3715–3305*
HAR-6136	A6 F125(a)	Butchered bone	Area 6. Cluster of butchered bone stratified above Neolithic occupation (Needham 1991, 55, figs 19, 20)	4270±110	−21.0		3330–2570	*3270–3230* (*1%*) or *3125–2565* (*94%*)
Eton Rowing Course, Berkshire: Area 6 midden								
GrA-22561	DBC97 <82706> (11176) A6	Cattle. Mandible	11176. Midden-like upper fill of treehole	4970±45	−22.4		3940–3650	*3790–3650*
OxA-12238	SF 77496	Cattle. Pelvis	11160. Midden deposit on surface 11201	4701±34	−21.3		3640–3370	*3640–3555* (*89%*) or *3530–3495* (*6%*)
GrA-22560	DBC96 <23932> (5986) A6	Cattle. Phalanx	11160. Midden deposit on land surface 11201	4910±45	−22.6		3790–3630	*3765–3635*
OxA-9850	SF 84566	Carbonised residue on pottery	11320. Upper fill of tree-throw hole 11352	4645±55	−28.1		3630–3340	*3640–3555* (*87%*) or *3530–3465* (*8%*)
OxA-9851	SF 84429	Carbonised residue on pottery	11313. Finds-rich, midden-like upper fill of tree-throw hole 11352	4760±50	−27.3		3650–3370	*3655–3520*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
OxA-9891	SS 2307 (11159)	Charred emmer grain	11159. Part of general land surface deposit 11201	4910±40	−24.6		3780–3630	*3760–3635*
OxA-9852	SF 50842	Carbonised residue on pottery	8194. Part of land surface 11201	5110±90	−26.4		4230–3700	*3830–3645*
OxA-9924	SF 82319	Carbonised residue on pottery	11194. Upper fill of tree-throw hole 11345	4920±65	−25.5		3930–3530	*3785–3630*
OxA-9925	SF 82594	Carbonised residue on pottery	11344. Lower fill of tree-throw hole 11345	5240±85	−28.6		4300–3820	
OxA-10660	SF 82594	Carbonised residue on pottery. Repeat of OxA-9925	From the same context as OxA-9925	4915±55	−30.5		4300–3820	*3775–3635*
OxA-9819	SS 2302 (11172A)	Charred emmer grain	11172. Midden deposit on land surface	4925±40	−25.9		3790–3640	*3770–3640*
OxA-9859	SS 2304 (11187)	Charred emmer grain	Upper fill of tree-throw hole 11190	4895±50	−26.1		3780–3540	*3770–3630*
OxA-9889	SS 2306 (11160)	Charred emmer grain	1160. 'midden' deposit on land surface 11201	4935±40	−24.5		3800–3640	*3775–3645*
OxA-9890	SS 2317 (11194)	Charred hazelnut shell	11194. Midden-like upper fill of tree-throw hole 11345	4995±40	−25.6		3950–3660	*3800–3655*
Eton Rowing Course, Berkshire: human remains								
BM-3170	5856	Human. Infant femora	Crouched burial in shallow pit 5991, SW of ring ditch 5579 (Ambers and Bowman 2003, 533)	4400±50	−23.2		3330–2900	*3330–3225* (*14%*) or *3180–3155* (*2%*) or *3125–2900* (*79%*)
BM-3173	5587	Human. Adult R femur and L humerus	Crouched burial of 30–40 year-old in pit 5888, SE of ring ditch 5579 (Ambers and Bowman 2003, 533)	4500±60	−21.3		3370–2930	*3370–3010*
OxA-8820	SF 46603	Human. Skull	Area 5, 3839	4795±50	−21.1		3660–3370	*3660–3495* (*87%*) or *3430–3375* (*8%*)
OxA-9525		Waterlogged seeds	From the same context as OxA-8820	4641±38	−25.2		3620–3350	*3520–3350*
OxA-8821	SF 45025	Human. Skull	Area WB96, 7004	4410±45	−21.2		3330–2900	*3330–3225* (*16%*) or *3180–3155* (*2%*) or *3125–2910* (*77%*)
Eton Rowing Course, Berkshire: Area 10 midden								
OxA-10206	DBC 40929	Carbonised residue on pottery	6880. Discrete flint scatter in shallow hollow N of early Holocene channel crossing gravel terrace	4565±60	−26.9		3500–3090	*3495–3455* (*3%*) or *3380–3090* (*92%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-9671	DBC 32522	Carbonised residue on pottery	6331. Sandy silt filling top of early Holocene channel crossing gravel terrace	4590±150	−32.0		3660–2900	*3535–3000*
OxA-9672	DBC 41577	Carbonised residue on pottery	From the same context as OxA-9671	4520±120	−27.8		3630–2890	*3500–3010*
BM-3188	6915	Cattle. Vertebrae	6331. Semi-articulated group of animal bones in layer containing midden material (Ambers and Bowman 2003, 534)	4530±50	−19.9		3490–3020	*3365–3095*
Eton Rowing Course, Berkshire: palaeochannels								
OxA-8752	SF 45000	Red deer. Antler	Area WB96. 7005. On bank of channel with cattle skull beneath the antler	4425±40	−21.4		3340–2910	*3270–3225* (*4%*) or *3185–3155* (*3%*) or *3135–2915* (*88%*)
OxA-8815	SF 45001	Cattle. Skull	Area WB96 7005. On bank of channel with antler over it	4500±50	−22.7		3370–3020	*3365–3080*
BM-3177	SF 62341	Cattle (domestic). R radius	Area EX3, 10190. Partly articulated skeleton in palaeochannel, close to bank, associated with plain Bowl pottery	4750±50	−23.8		3640–3380	*3640–3495* (*70%*) or *3460–3375* (*25%*)
BM-3185	718	*Corylus avellana* branchwood <10 rings, beaver-gnawed	Area EX1, 718. Beaver-gnawed wood associated with Ebbsfleet Ware, struck flint, animal and human bone in a palaeochannel	4700±50	−27.4		3630–3370	*3635–3555* (*24%*) or *3540–3365* (*71%*)
CAMS-57208		Waterlogged seeds	Area 3, 3333. Palaeochannel deposit showing disturbance of woodland cover. From separate sequence to CAMS-57207	4800±40	−27.7		3660–3400	*3660–3515* (*94%*) or *3400–3380* (*1%*)
CAMS-57207		Waterlogged seeds	Area 15, 4826. Inlet Z. Palaeochannel deposit showing disturbance of woodland cover. From separate sequence to CAMS-57208	4730±40	−27.9		3630–3380	*3635–3495* (*62%*) or *3460–3375* (*33%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Eton Rowing Course, Berkshire: other contexts								
OxA-9412		Waterlogged seeds	Area EV, 4611. Waterlogged deposit in base of tree-throw hole underlying late Mesolithic assemblage	6130±45	−24.0		5210–4940	
Cannon Hill, Maidenhead, Berkshire								
HAR-1198	CHN74	Unidentified bulk charcoal sample	Layer 4 of a probable solution pipe, associated with light-rimmed Carinated Bowl pottery, Mesolithic artefacts also present (R. Bradley *et al.* 1981)	5270±110	−25.3		4260–3960	*4340–3925 (91%)* or *3880–3800 (4%)*

Staines enclosure, is unfortunately undated, although, on the basis of the dates of other linear monuments in the Thames Valley, it may be contemporary with or later than the enclosure (Barclay and Bayliss 1999, figs 2.2 and 2.5). There is a small amount of plain Bowl pottery from the primary fills of the cursus ditches (Framework Archaeology 2006, 49–51, table 2.7). It is argued persuasively that the C1 Stanwell cursus, at least 3.6 km long, took the form of a long bank some 1.20 m high and 5 m wide (Framework Archaeology 2006, 48–9, 54–7). It is suggested that it served to alter, bisect but also visibly connect points in the landscape, by now partially cleared; such activity, begun in construction and continued in maintenance of the monument, may have served to create, formalise and celebrate an emergent community in the local area (Framework Archaeology 2006, 52–9). If, however, the C1 Stanwell cursus monument came after the Staines and other local enclosures (*contra* Framework Archaeology 2006, 52), a different trajectory of social change must be considered. The C1 cursus may have been cut by the less regular ditches of the C2 cursus, also undated, which has been suggested to have lacked a central bank and to have been a more exclusive monument (Framework Archaeology 2006, 69–72, 80). Perhaps both C1 and C2 monuments are part of a process of change following the earlier development of causewayed enclosures.

A little further upstream, the causewayed enclosures of Eton Wick and Dorney were built in an area which had already witnessed Neolithic activity, dating from probably the 38th century cal BC onwards. Early Neolithic finds have been discovered in a variety of contexts in the very large areas excavated at Eton, including middens, occupation spreads, tree-throw holes and pits, although not all of these have radiocarbon dates (T. Allen *et al*. 2004, fig. 9.2).

The Eton Rowing Course site was sub-divided into a series of Areas. The Area 6 midden deposits covered an area of *c*. 200 m by 25 m and comprised a dark, charcoal-rich soil with distinct spreads of finds within hollows in the underlying surface (T. Allen *et al*. 2004). Radiocarbon dates on charred cereals, animal bone, carbonised residues on pottery sherds and a hazelnut shell from the midden indicate that material was probably deposited here between the 38th and the earlier 36th century cal BC, from *3885–3695 cal BC* (*95% probability*; Fig. 8.8: *start area 6 midden*), probably from *3810–3725 cal BC* (*68% probability*), to *3630–3425 cal BC* (*95% probability*; Fig. 8.8: *end area 6 midden*), probably to *3620–3555 cal BC* (*68% probability*). Based on the analysis of the finds and stratigraphic evidence, the excavators believe that material was deposited in the midden episodically over this period of time (T. Allen *et al*. 2004, 85–91). Carinated Bowl and Abingdon Ware, for example, occur in discrete deposits (Alistair Barclay, pers. comm.). This activity predated the construction of the inner circuit of the Eton Wick enclosure (*83% probable*).

Two separate environmental sequences from the Eton Rowing Course suggest clearance at this time (Fig. 8.9: *CAMS-57207–8*). Other activity has also been radiocarbon dated to this period. Statistically consistent measurements

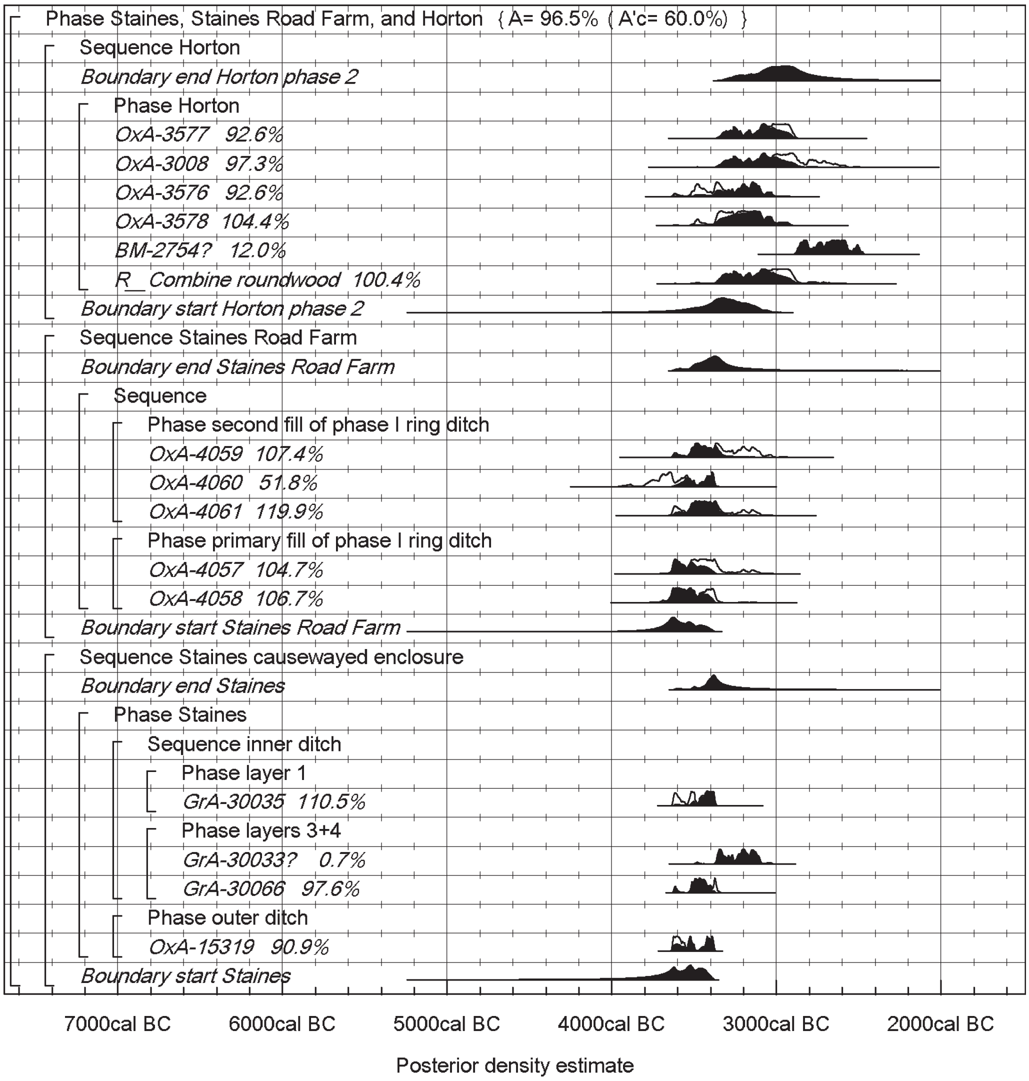


Fig. 8.7. Staines, Horton and Staines Road Farm, Shepperton. Probability distributions of dates from the causewayed enclosure and the two monuments. The format is identical to that of Fig. 8.3. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

have been obtained on a cattle radius associated with plain Bowl pottery, recovered from a palaeochannel in Area EX3, and beaver-gnawed wood associated with Ebbsfleet Ware in a palaeochannel in Area EX1 (Table 8.3: *BM-3177*, -*3185*; T'=0.5; T'(5%)=3.8; ν=1). Statistically inconsistent measurements have been obtained on a human skull found at the edge of a palaeochannel in Area 5 and from waterlogged seeds in the same context (Fig. 8.9; Table 8.3: OxA-*8820*, -*9525*; T'=6.0; T'(5%)=3.8; ν=1), suggesting that the skull entered the palaeochannel some time after the death of the individual represented.

Four statistically consistent radiocarbon determinations have been obtained on samples from another extensive midden in Area 10 at Eton (Table 8.3: T'=0.3; T'(5%)=7.8; ν=3). Three of the samples were on residues on pottery and one on cattle bone. Two of the residue samples (*OxA-9671–2*) and the one cattle vertebra (*BM-3188*) were from the upper fill of an earlier channel, and the third residue sample (*OxA-10206*) from a discrete flint scatter in a hollow. The radiocarbon dates suggest that the Area 10 midden was accumulating during the last third of the fourth millennium cal BC (Fig. 8.9). But only four samples have been dated: a small assemblage which may or may not be representative of the date of the midden as a whole. The dated sherds were in fact undiagnostic, and the ceramic assemblage from the Area 10 midden as a whole includes Carinated Bowl, plain Bowl and Peterborough Ware (Alistair Barclay, pers. comm.), which might indicate that midden deposition began earlier, assuming that none of the ceramic material is residual.

Other activity dated to the end of the fourth millennium cal BC includes two crouched burials (Fig. 8.9; Table 8.3: *BM-3170, -3173*), a human skull (Fig. 8.9: *OxA-8821*), and animal bone deposited in a palaeochannel (Fig. 8.9: *OxA-8752, -8815*).

It is therefore reasonable to suggest that the Eton Wick

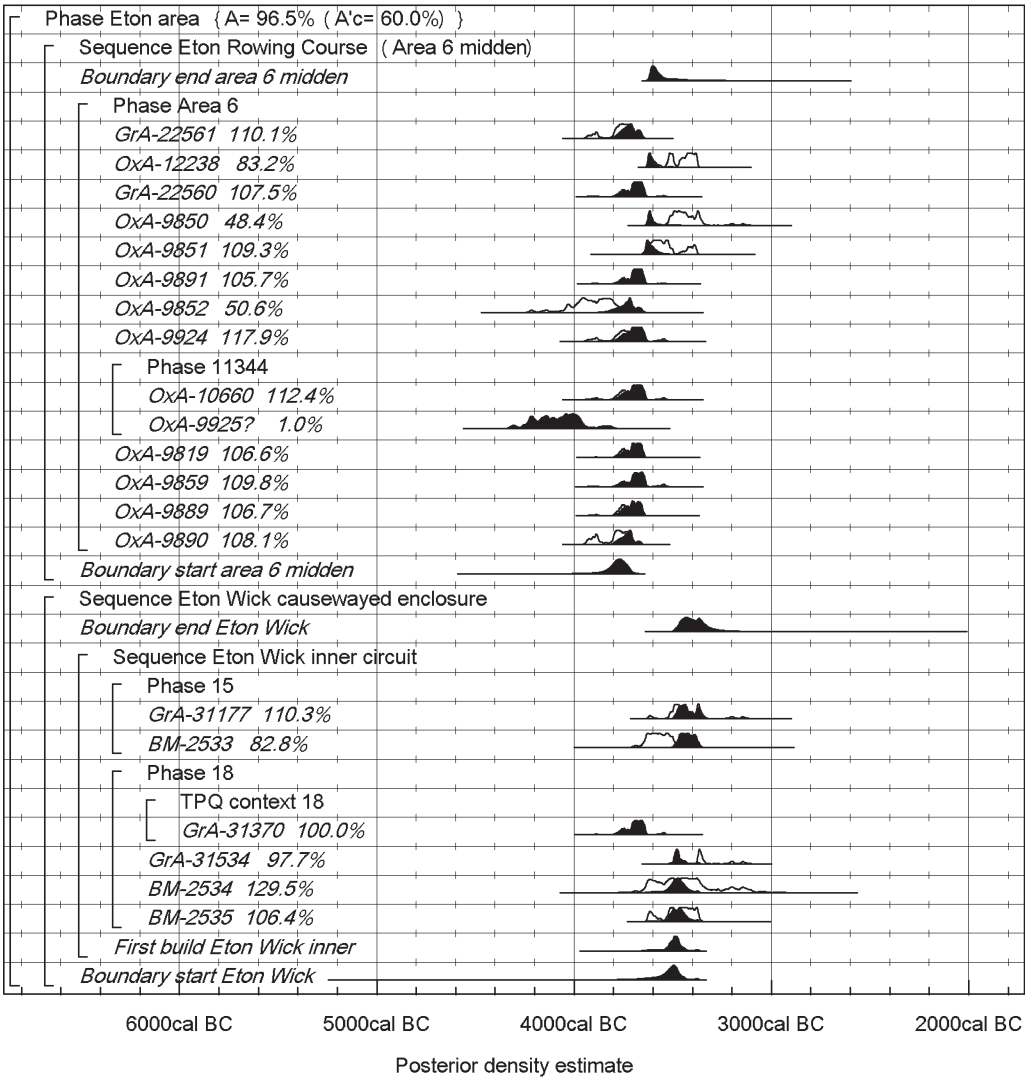


Fig. 8.8. Eton Wick and the area 6 midden at the Eton Rowing Course. Probability distributions of dates. The format is identical to that of Fig. 8.3. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

and Dorney enclosures were constructed in a landscape which had already been inhabited by Neolithic communities, perhaps for a number of generations, and that this activity continued through the life of the enclosures and after their use. It can be noted that late Mesolithic finds have also been recovered from these areas (see further below). On morphological grounds, an assemblage of light-rimmed Carinated Bowl from the upper part of a solution pipe at Cannon Hill, Maidenhead, 4 km to the north-west, might be as early as the first elements of the Area 6 midden (R. Bradley *et al.* 1981). The single associated radiocarbon date, however, was made on unidentified bulk charcoal and can be treated only as a *terminus post quem* (Fig. 8.9: *HAR-1198*), especially since Mesolithic artefacts were present. Potentially later are two lugged Bowls, the more complete of them decorated and in some ways similar to the Abingdon assemblage, from a pit at Remenham, some 12 km west of Cannon Hill (Holgate and Start 1985).[1]

We are still far from understanding the patterns of existence of daily life in the middle Thames but the evidence just reviewed shows the range of situations which we have to take into account. Perhaps we can suggest here too, as elsewhere in southern Britain, a mixture of comings and goings, short-term occupations – both seasonal and annual – and longer-lasting maintenance of place. In this context, the formalities suggested for Staines, in terms of a plan with a definable front and back, and structured deposition emphasising complementary zones of the enclosure layout through different materials (P. Bradley 2004, 116–9), offer one locale where people could have gathered in numbers to play out common concerns. It is worth remembering the large quantities of artefacts in the excavated portions of the site (P. Bradley 2004, 116), even though we have little idea of the timespan over which the enclosure was created and used.

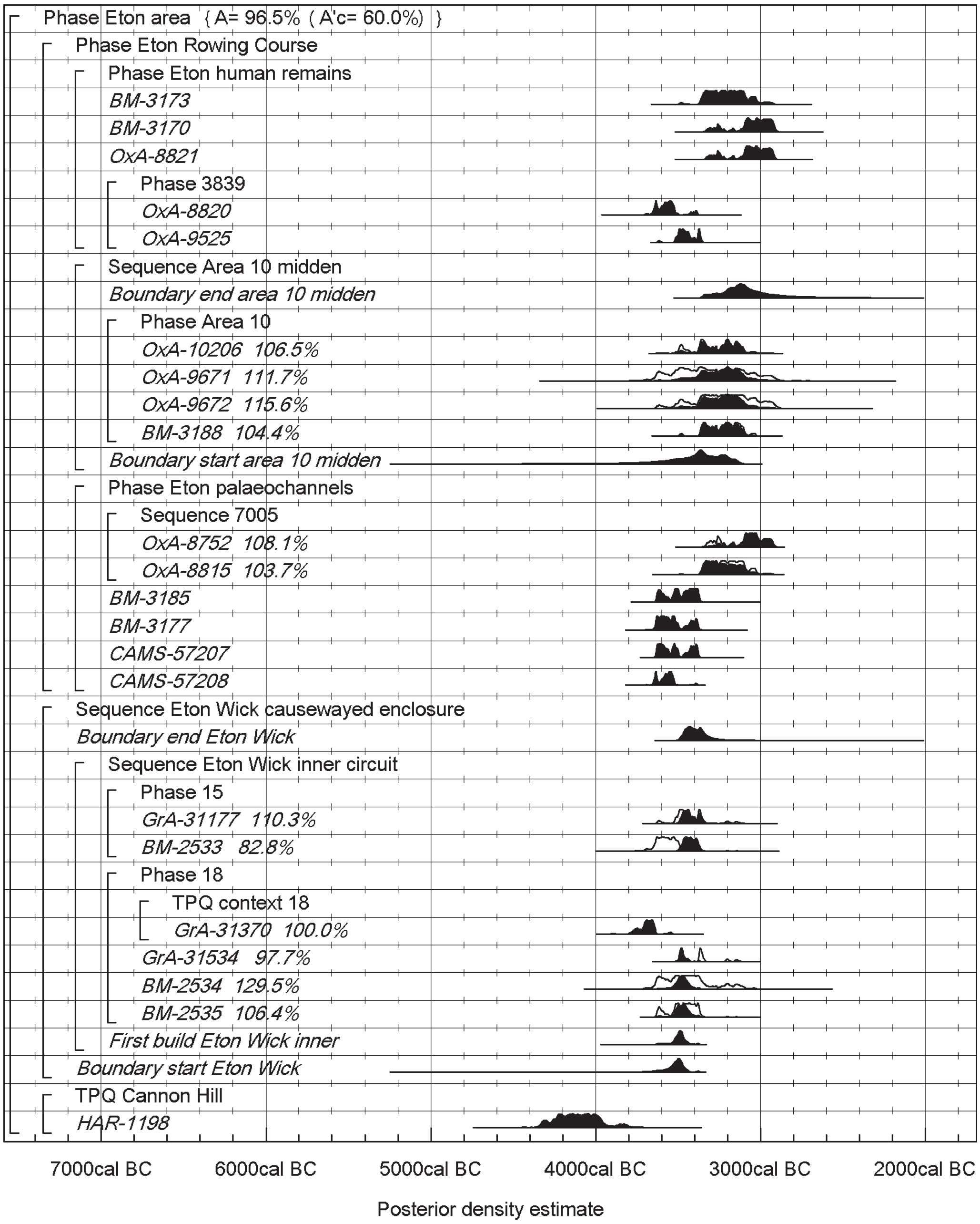


Fig. 8.9. Eton Wick, Cannon Hill and other fourth millennium activity at the Eton Rowing Course. Probability distributions of dates. The format is identical to that of Fig. 8.3. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

8.4 Gatehampton Farm, Goring, Oxfordshire, SU 6045 7970

Location and topography

Gatehampton Farm lies at 40 m OD on the north bank of the Thames in the narrowest part of the Goring Gap, where the river cuts through the Chalk, less than 20 km upstream from an unexcavated probable causewayed enclosure at Eye and Dunsden and approximately 20 km downstream from Abingdon (Fig. 8.1). The enclosure occupies a sloping flint gravel terrace, overlain by sands, silts and clays and dissected by palaeochannels, between the chalk escarpment and the edge of the floodplain. It consists of two arcs of rarely interrupted but pit-dug ditch, the inner springing from and perhaps cutting the line of the outer, with an entrance to the north-east, open to the Thames to the south and enclosing perhaps as much as 7 ha (Fig. 8.10).

Within the enclosure are seven Bronze Age round barrows. A further six ring ditches lie to the north.

History of investigation

The enclosure was discovered in the course of investigations undertaken by the then Oxford Archaeological

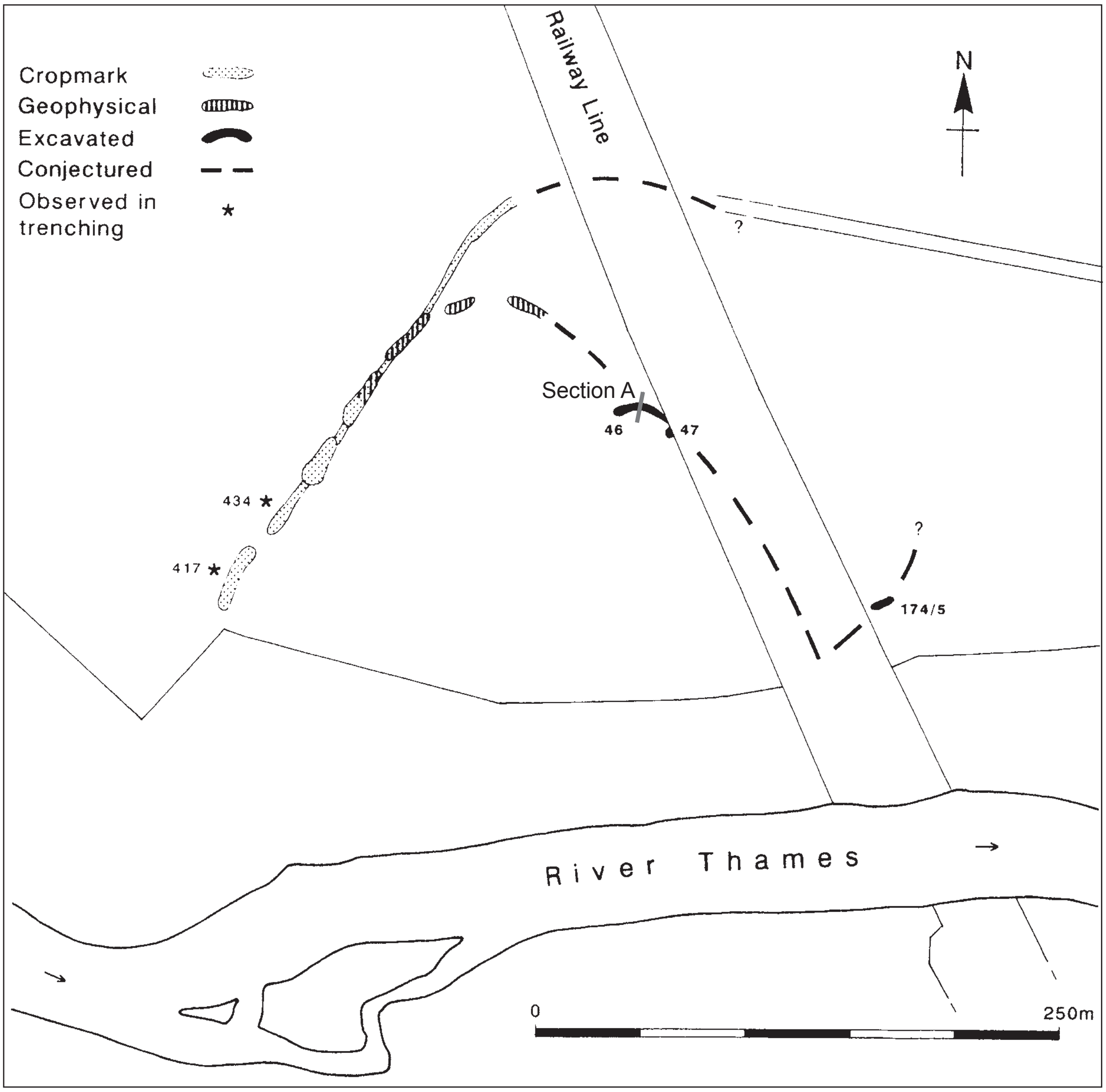


Fig. 8.10. Gatehampton Farm, Goring. Possible extent of enclosure, based on excavation, air photographs and geophysical survey. After T. Allen (1995, fig. 64)

Unit for Thames Water in advance of the construction of a water supply depot and feeder pipeline in 1985–7 and the re-laying of cable trenches in 1992. These were directed initially by George Lambrick and principally by Tim Allen (T. Allen 1995). Excavation was restricted and linear, the plan and scale of the enclosure being determined from aerial photographs and geophysical survey (Fig. 8.10).

In the west of the circuit, a small trench showed that a ditch at least 5.20 m wide was overlain by material eroded, in the Romano-British period or subsequently, from an Early Bronze Age barrow mound (T. Allen 1995, 33–9, 119). In the east, five metres of ditch were excavated close to one side of an apparent entrance (T. Allen 1995, 23–8, 119–20). Here the ditch was over 2 m wide and deep, with a flat bottom and steep sides which were suggestive of rapid infill, given the instability of the sands, silts, silty clays and gravels through which it was dug. It was infilled with lenses of all four. A lens of dark sandy silt with charcoal was 0.20–0.40 m above the base (Fig. 8.11: 46/4b). The sequence may possibly, although not certainly, have been interrupted by a recut a little above this, at the base of which was a further lens of dark sandy silt with charcoal (Fig. 8.11: 46/4a). Above both of these, rather more than half way up the fill, was the articulated skeleton of an 8–9 year-old. Small quantities of plain Neolithic Bowl, almost all flint-tempered and including closed forms, occurred throughout the possible recut and perhaps below it (Cleal 1995c, 85–6, 93). On inspection, this is fairly weathered, although some fragments are large. A small quantity of struck flint from all levels was thought to date to 'the late part of the earlier Neolithic or later' (A. Brown 1995, 78). F47, a further possible ditch just south of F46, may have been contemporary. F174 represents Neolithic activity of some kind on the edge of an adjacent palaeochannel (T.

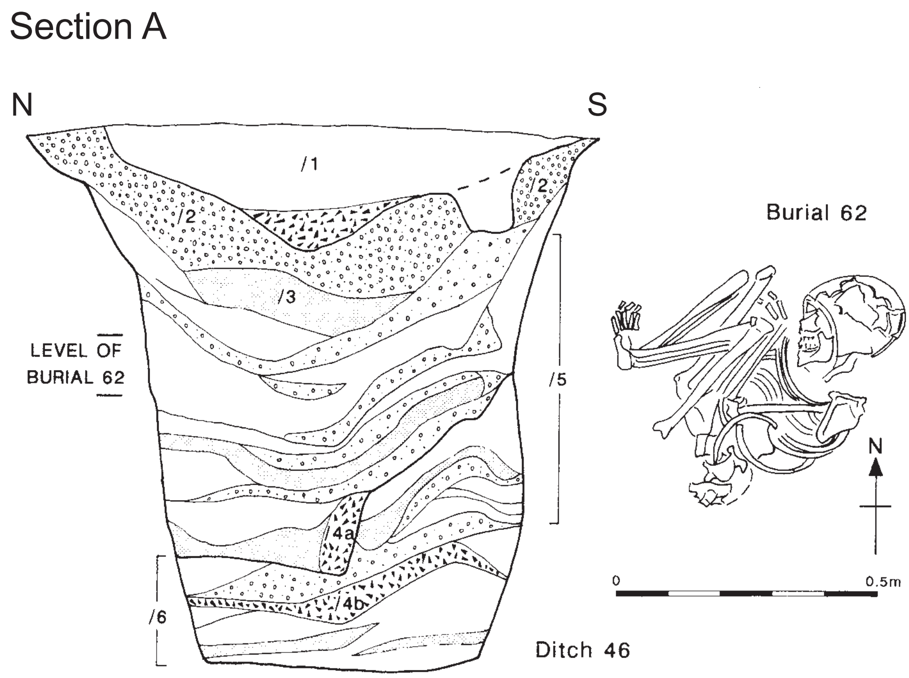


Fig. 8.11. Gatehampton Farm, Goring. Section through ditch 46. After T. Allen (1995, fig. 18).

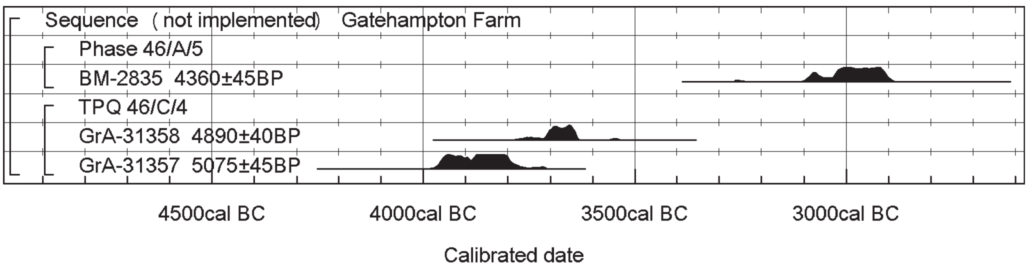


Fig. 8.12. Gatehampton Farm, Goring. Probability distributions of calibrated radiocarbon dates (Stuiver and Reimer 1993). Although there is a stratigraphic sequence between the samples this has not been implemented as a formal model for reasons discussed in the text.

Allen 1995, 15–17, fig. 64). Oswald *et al.* (2001, 154) considered the site unlikely to be a causewayed enclosure, on the grounds of its atypical plan and the lateness of one date that had been obtained when they wrote.

Previous dating

Following the excavation, the child burial was dated to 3100–2890 cal BC (95% confidence; Table 8.4: BM-2835; Ambers and Housley 1995), the sample being prepared and measured as described by Ambers and Bowman (1994).

Reassessment and modelling of existing dates

BM-2835 was measured on a sample from an articulated skeleton and must be close in age to its context.

Objectives of the dating programme

The main aim was to see if the original excavation of the ditch preceded the late fourth/early third millennium date of the burial by any appreciable time.

Sampling strategy and simulation

The small scale of the excavation severely restricted the potential for sampling. No articulating bone could be found, and the only samples dated were two short-lived charcoal fragments (Table 8.4: GrA-31357–8). Their contexts are problematic because, although two charcoal-rich lenses were distinguished in section, one above and one below the recut (Fig. 8.11), they were both excavated as a single context, layer 4. Both were, however, distinct concentrations of charcoal, likely to have derived from discrete events.

Results and calibration

The details of the samples and measurements from the site are provided in Table 8.4. The probability distributions of the calibrated dates of these measurements are shown in Fig. 8.12.

Table 8.4. *Neolithic radiocarbon dates from Gatehampton Farm, Oxfordshire.*

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**
GrA-31357	46/C/4 charcoal A	Single fragment Pomoideae	Ditch F46, context 46/C/4. From 1 of 2 charcoal-rich lenses, 1 in lower fill below apparent recut, 1 above it (T. Allen 1995, fig. 18). While these are differentiated as 4a and 4b in the published illustration, they are both shown simply as 4 in the original pencil drawing. Both, however, were stratified below the burial dated by BM-2835	5075±45	−25.8	3980–3710
GrA-31358	46/C/4 charcoal B	Single fragment Pomoideae	As GrA-31357	4890±40	−25.7	3760–3630
BM-2835	62	Human. Sample from articulated burial of 8–9 year-old child	Ditch F46, context 46/A/5, some way above an apparent recut	4360±45	−20.5	3100–2890

Analysis and interpretation

The two radiocarbon results on the charcoal fragments from layer 4 are statistically inconsistent (T'=9.5; T'(5%)=3.8; ν=1) and are substantially older than the overlying skeleton (Fig. 8.12). There are several possible reasons for this. One sample may have come from the lower lens and one from the upper. Some or all of the charcoal may have been derived from a pre-existing pit or hearth, since there was a human presence in the immediate area in the late Mesolithic and early Neolithic (A. Brown 1995). Given the location, already old waterlogged wood may have been dried and burnt. Conservatively, the more recent of the two is taken as providing a *terminus post quem* for the construction of the earthwork of 3770–3630 cal BC (95% confidence; Fig. 8.12: GrA-31358), probably 3670–3630 cal BC (68% confidence). A *terminus ante quem* for the construction of the earthwork is provided by the date on the articulated burial cut into the upper fills (95% confidence; 3100–2890 cal BC; BM-2835).

Implications for the site

The possibility of a construction date for the enclosure in the 37th century cal BC suggests that it may have been in use at the same time as others in the catchment. If so, the long interval between initial construction and the child burial strengthens the argument for a recut, since the unstable ditch sides would not have remained so close to vertical if they had weathered for centuries. The burial may relate to occupation of the site by users of Peterborough Ware (T. Allen 1995, 18–23, 120–2; Cleal 1995c, 86–92).

8.5 Abingdon, Oxfordshire, SU 5112 9825

Location and topography

The Abingdon enclosure lies at 60 m OD on a low promontory on the second gravel terrace of the Thames, in the confluence of two streams (Fig. 8.1). It was formed by two causewayed ditches which cut off the tip of the promontory, perhaps originally enclosing some 3 ha (Fig. 8.13).

The enclosure is close to Neolithic monuments and burials at Barrow Hill, Radley (Barclay and Halpin 1999), and to an unexcavated site which may be a single-circuit causewayed enclosure in the same parish 2.8 km to the north-east, partly masked by alluvium, on a gravel island in the Thames floodplain (Oswald *et al*. 2001, 154, fig. 4.22). The very small size of this cropmark (which has a maximum dimension of *c*. 60 m) may, however, suggest an alternative attribution.

History of investigation

The inner circuit was discovered in the 1920s in the course of gravel quarrying and was partly excavated by E. T. Leeds (1927; 1928; Fig. 8.14). Three segments were wholly or

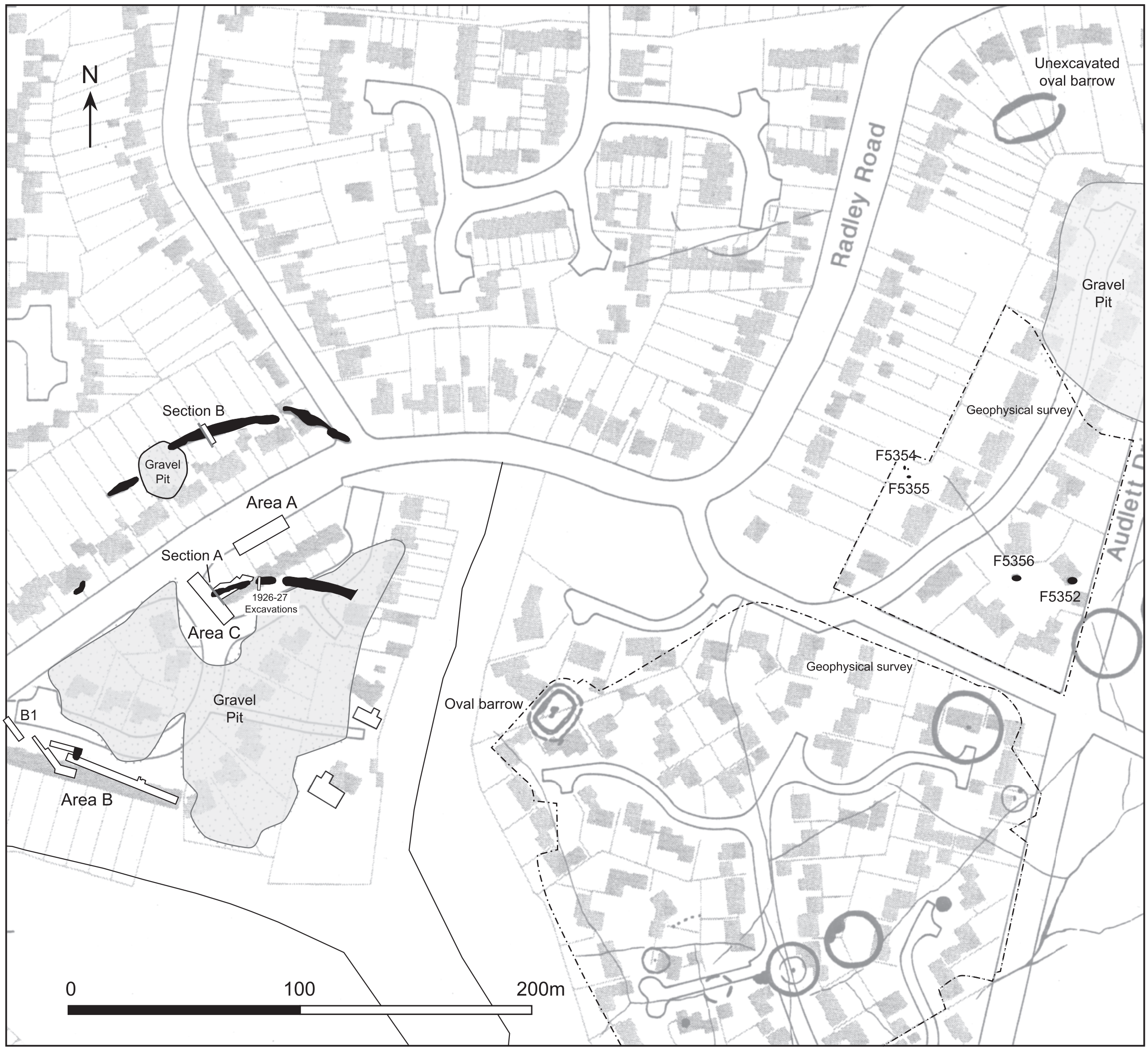


Fig. 8.13. Abingdon and adjacent parts of the Barrow Hills complex. Plan showing the ditches of the enclosure as far as they are known and the location of cuttings. After Barclay and Halpin (1999, figs 1.4, 1.10).

Fig. 8.14. Abingdon. E. T. Leeds' excavations in the late 1920s. Photos from the Ashmolean Museum, University of Oxford.

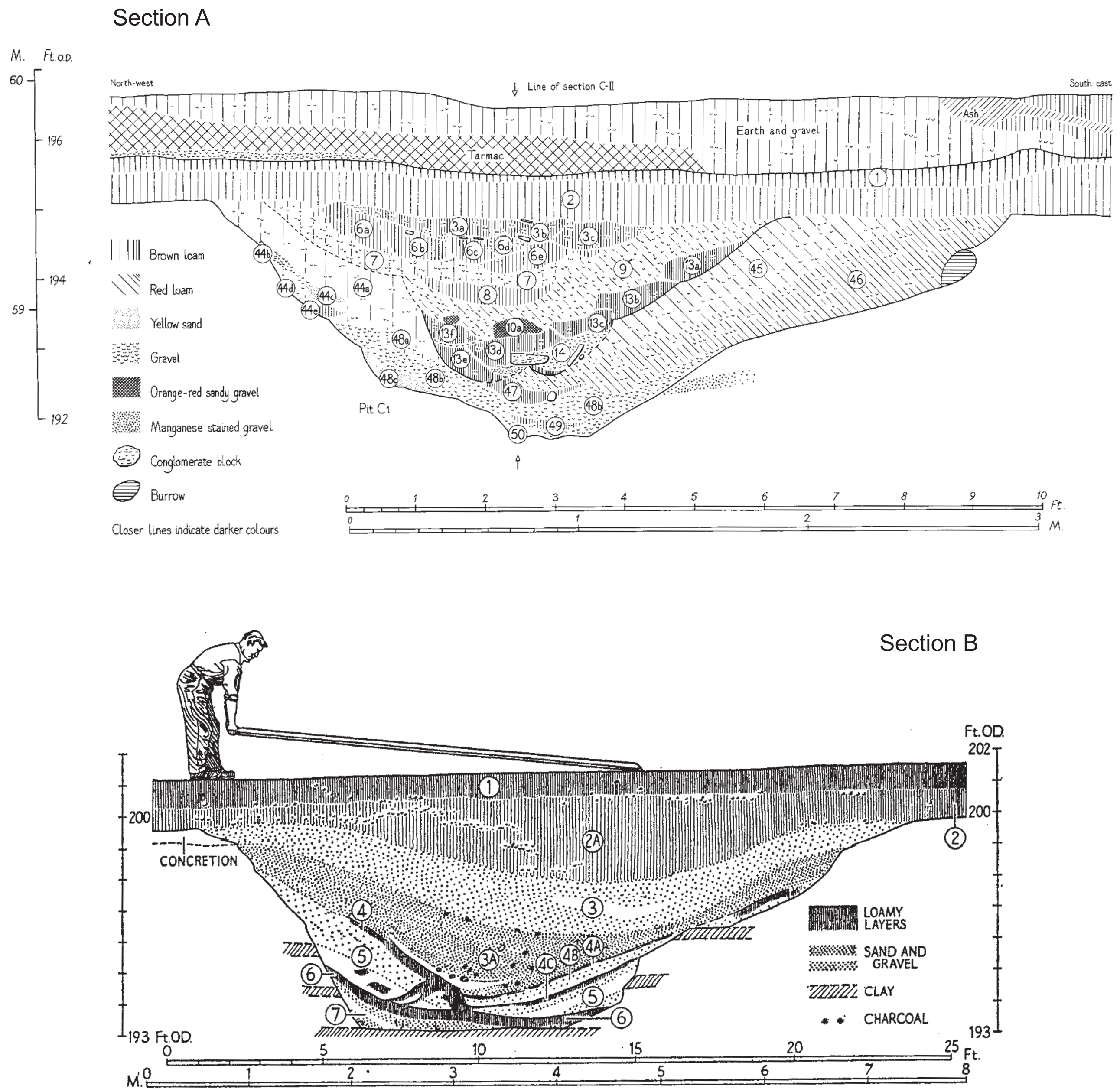


Fig. 8.15. Abingdon. Sections through the inner ditch, excavated by Michael Avery in 1964 (upper) and the outer ditch, excavated by Humphrey Case in 1954 (lower). After Avery (1982, fig. 6) and Case (1956, fig. 2).

partly excavated at this time, as well as a couple of pits in the interior. This was for many years the only known causewayed enclosure on river gravels rather than on a hill. Leeds, indeed, surmised that its occupants might have been driven from the Chalk downs by the pressure of Beaker-using invaders (1927, 462). Finds were abundant, despite the small scale of the excavation; Leeds retrieved 91 lb (41 kg) of pottery, on the basis of which Abingdon Ware was defined (Piggott 1954, 72–5). Animal bone and antler, worked and unworked, were plentiful, including several antler combs (Leeds 1927, pl. LII: fig. 1). Leeds recognised that Chalk flint and axeheads of non-local rock (in fact of group VI: Avery 1982, 40) had been brought to the site (1927, 448, 462; 1928, 469). As well as disarticulated human remains in the excavated segments, two articulated burials of unknown date were observed in another segment during gravel quarrying (Leeds 1928, 476; 1929).

The outer circuit was identified in the 1950s from an air photograph taken in the inter-war period, and was sectioned in 1954 by Humphrey Case in the garden of one of the houses which by then covered the site (1956). In this single section the outer ditch was deeper (approximately 2 m below the surface of the gravel subsoil) and less rich in finds than the inner, and seemed to have silted naturally (Fig. 8.15).

Further excavation of the remaining unquarried parts

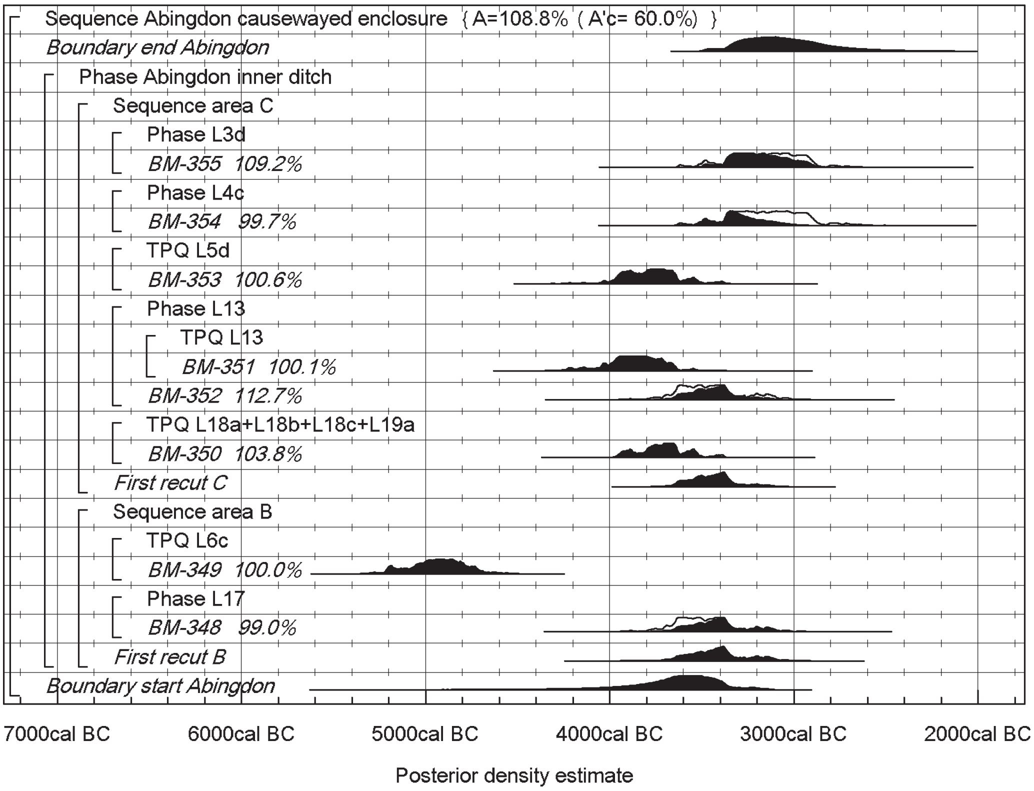


Fig. 8.16. Abingdon. Probability distributions of dates from the inner ditch obtained before 1971. The format is identical to that of Fig. 8.3. The large square brackets down the left-hand side, along with the OxCal keywords, define the overall model exactly.

of the inner circuit and interior was undertaken in 1963–4 by Michael Avery in advance of house-building (1982). He completed the excavation of a segment partly emptied by Leeds in area C; sectioned a previously unexcavated segment in area B, 90 m to the south-west; and opened area A between the inner and outer ditches. Both segments of the inner ditch had been recut when substantially silted, and it was these recuts rather than the original silts which were rich in finds (Avery 1982, tables 1, 9, 16), having been filled with basket-sized tips of both clean gravel and organic deposits with much cultural material (Fig. 8.15; Avery 1982, figs 6–8, 11–12). In the area between the inner and outer ditch were an undated crouched inhumation and a possibly Neolithic pit. Analysis of the artefacts from these excavations provided the opportunity for a reassessment of the larger assemblage recovered by Leeds (Avery 1982, 26–43).

The results of the 1954 and 1963–4 excavations were worked into a constructional sequence in which the outer ditch was dug to provide a larger enclosure, at a time when settlement in the interior of the inner ditch was abandoned, and its debris buried in that ditch interleaved with clean gravel newly dug from the outer ditch (Avery 1982, 12, 24). Richard Bradley (1992) questioned this interpretation on the grounds that the artefacts and animal bone from the recut in the inner ditch are too well preserved to have been exposed in the interior prior to burial, and saw the differences between the two ditches as functional rather than chronological. His emphasis on the freshness and good preservation of the material from the inner ditch recut is reinforced by the identification of more than 20 animal bone articulations and several fitting unfused epiphyses from these contexts in the course of this project.

Previous dating

Eight samples from the inner ditch were submitted to the British Museum after the 1963–4 excavations. None came from below the recut. They were prepared and counted following the methods described by H. Barker *et al*. (1971). The results have been assessed by Ambers *et al*. (1999).

Reassessment and modelling of existing dates

A model for the chronology of the Abingdon causewayed enclosures using determinations obtained in the late 1960s is shown in Fig. 8.16.

In area B, a bulk charcoal sample from the base of the recut is described in a letter from Michael Avery as consisting of pieces of twig size; and the amount of well preserved charcoal surviving from this layer indicates that the deposit was substantial and fresh. While the sample may have contained material of mixed age, BM-348, which was measured on it, may be close in age to its context. The same letter describes the other four charcoal samples (BM-349–51 and -353) as made up of widely scattered, tiny

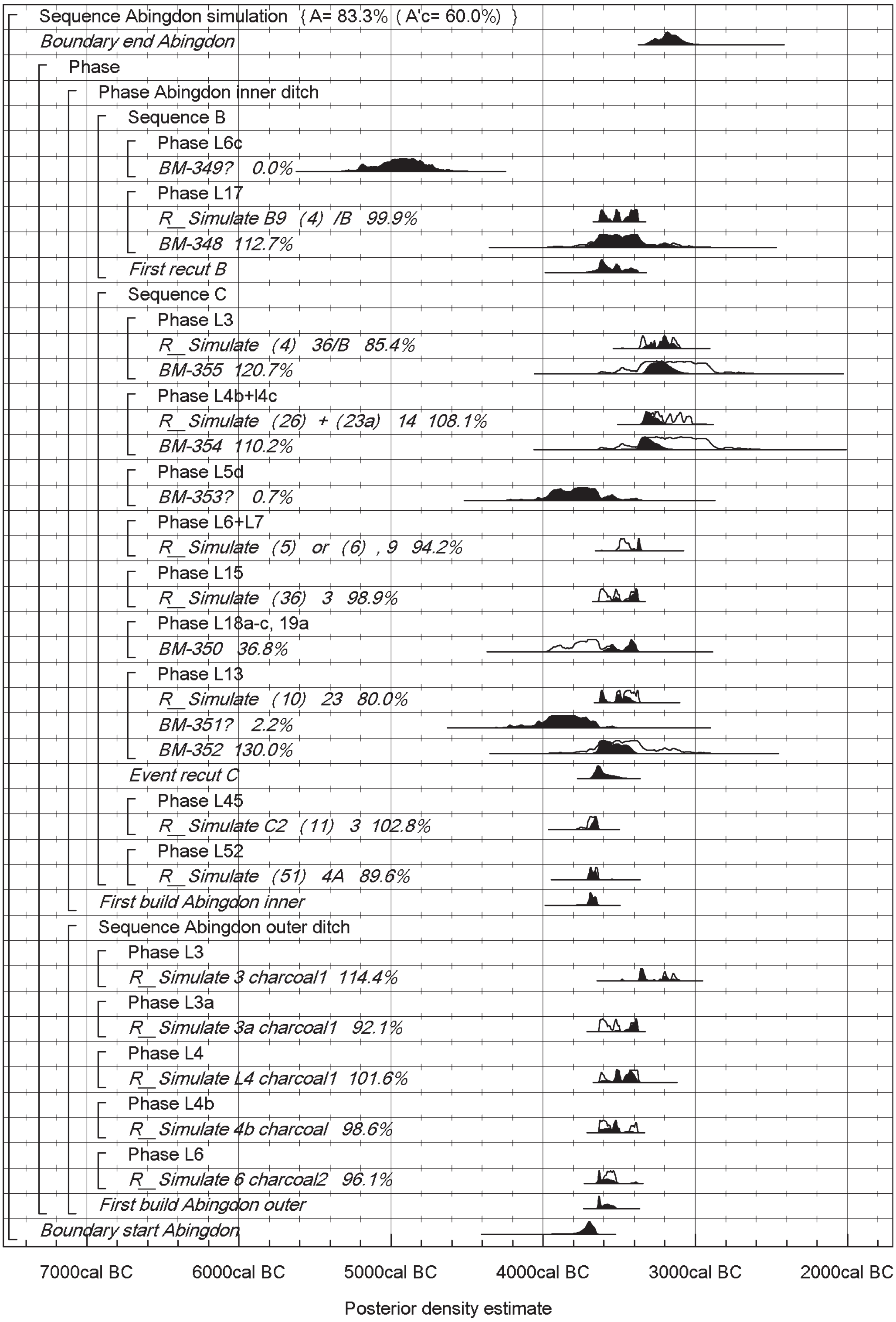


Fig. 8.17. Abingdon. Probability distributions of dates obtained before 1971 and simulated dates from suitable material identified in archive. The format is identical to that of Fig. 8.3. The large square brackets down the left-hand side, along with the OxCal keywords, define the overall model exactly.

fragments. They are all thus likely to have derived from several events and to include material of diverse ages. A case in point is BM-349, which was stratified above BM-348 but dates to the late sixth or early fifth millennium cal BC. Already old charcoal may have derived from a Mesolithic presence represented by a microlith from Leeds' excavations (Leeds 1927, fig.5: m), by Mesolithic artefacts in the wider neighbourhood, and by oak charcoal dated to 7460–6655 cal BC (95% confidence; 8100±120 BP; OxA-1883) from a burnt-out tree-throw hole at Barrow Hills (Barclay and Halpin 1999, 17). These four samples (BM-349–51 and -353) have been treated as *termini post quos* for their contexts.

The three remaining samples were of bone or antler.

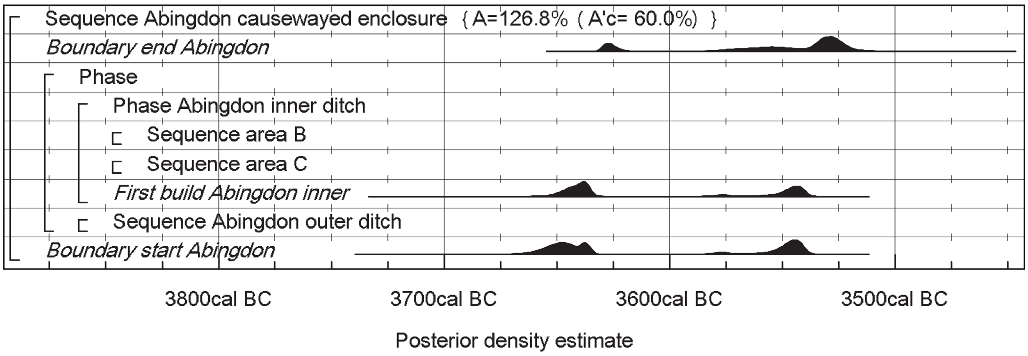


Fig. 8.18. Abingdon. Overall structure of the chronological model. The component sections of this model are shown in detail in Figs 8.19–21. The large square brackets down the left-hand side of Figs 8.18–21, along with the OxCal keywords, define the overall model exactly.

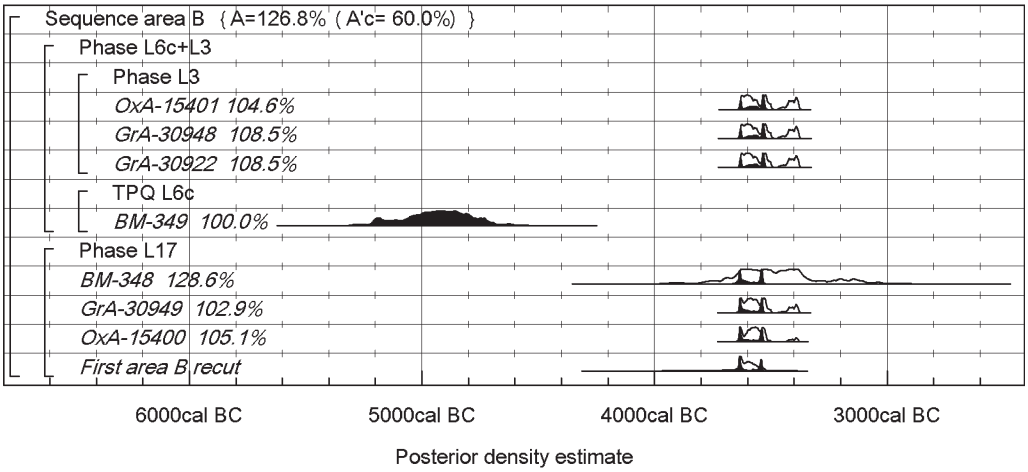


Fig. 8.19. Abingdon. Probability distributions of dates from the inner ditch in area B. The format is identical to that of Fig. 8.3. The overall structure of this model is shown in Fig. 8.18, and its other components in Figs 8.20–1.

BM-355 was an antler comb; BM-352 and -354 were single cattle bone fragments. All these measurements therefore relate to the deaths of individual animals, although, as they were recovered disarticulated, it is possible that one or more may have been redeposited. These three measurements are, however, statistically consistent with each other and with the putatively short-lived bulk charcoal sample from area B (T'=3.6; T'(5%)=7.8; ν=3). This may suggest that they were fresh when buried, and so the stratigraphic relationship between BM-352, at the base of the recut, and BM-355, from near its top, has been included in the model. The protein fraction of these samples was specifically selected for dating (H. Barker *et al*. 1971, 157), so these results may be accurate within the large quoted errors, making this assumption reasonable.

The existing dates provide provisional estimates for the recuts, and hence *termini ante quos* for the construction of the circuit, of, in area B, *3675–3095 cal BC* (*95% probability*; Fig. 8.16: *recut B*), probably *3620–3335 cal BC* (*68% probability*) and, in area C, *3660–3260 cal BC* (*89% probability*; Fig. 8.16: *recut C*) or *3255–3170 cal BC* (*5% probability*) or *3160–3130 cal BC* (*1% probability*), probably *3575–3345 cal BC* (*68% probability*).

Objectives of the dating programme

The principal aims were to date the construction of both circuits and to establish their relative chronology; to determine the length of time over which the enclosure was in use; to refine the estimates for the recuts in the inner circuit; and to relate the construction and use of the enclosure to developments nearby and elsewhere in the upper Thames catchment.

Sampling strategy and simulation

The inner ditch provided numerous articulating and fitting bone samples, some of them from below the recut, as well as further charcoal from the context of BM-348. No carbonised residues were found on the sherds, perhaps the result of assiduous cleaning followed by much handling over the decades, both deleterious to the surfaces of soft, shell-tempered fabrics. Only charcoal was accessible from the outer ditch, although bone and pottery are extant in the archive.

Once the available samples were identified, simulations such as shown on Fig. 8.17 were undertaken to determine the most effective number of samples to date.

Table 8.5. Radiocarbon dates from Abingdon, Oxfordshire. Posterior density estimates derive from the model defined in Figs 8.18–21.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
Inner ditch								
BM-348	Charcoal no. 1 (AB64, B9 : 4)	'As far as I can remember, the charcoal of sample 1 consisted of pieces of twig size' (carbon of letter in Michael Avery's archive in Ashmolean)	Trench B9, pit B3, L4 in field, L17 in publication. A primary fill of a recut of ditch segment (Avery 1982, fig.12)	4730±135			3790–3090	*3650–3585* (*51%*) or *3580–3525* (*44%*)
OxA-15400	Charcoal no. 1 (AB64, B9 : 4) A	1 fragment *Prunus spinosa*	From the same context as BM-348	4770±33	−28.2		3640–3380	*3640–3585* (*52%*) or *3580–3530* (*43%*)
GrA-30949	Charcoal no. 1 (AB64, B9 : 4) B	1 fragment *Prunus spinosa*	From the same context as BM-348	4755±35	−26.2		3640–3370	*3640–3585* (*52%*) or *3580–3525* (*43%*)
BM-349	Charcoal no. 2 (AB64, B10 : 2)	'As far as I can remember . . . the charcoal in samples 2, 3, 4 and 6 was obtained by collecting widely scattered and tiny fragments' (carbon of letter in Michael Avery's archive in Ashmolean). Date is weighted mean of two measurements which differed by 120 years, the second made to check the first, which was unexpectedly early	Trench B10, pit B3, L2 in field, L6c in publication. A middle fill, probably part of deliberate backfilling of a recut of ditch segment (Avery 1982, figs 10, 12)	6020±110			5220–4680	*5225–4680*
GrA-30922	B3 (3)	Cattle. First phalanx articulating with second phalanx	Trench B3, pit B3, L3. L3 is shown in Avery 1982, fig. 11.Equates to L4b+L6a+L6b+L6c+L8+L9 in Avery 1982, fig. 12	4740±35	−22.0		3640–3370	*3635–3620* (*15%*) or *3615–3520* (*80%*)
OxA-15401	B3 NwN (3) A	1 fragment Pomoideae	From the same context as GrA-30922	4738±33	−24.0		3640–3370	*3635–3620* (*15%*) or *3615–3520* (*80%*)
GrA-30948	B3 NwN (3) B	1 fragment Pomoideae	From the same context as GrA-30922	4740±35	−25.0		3640–3370	*3635–3620* (*15%*) or *3615–3520* (*80%*)
GrA-30942	C2 (51) 4/A	Cattle. R radius articulating with ulna (2). Replicate of C2 (51) 4/B	Trench C2, pit C1, L51 in field, L52 in publication. Lens within primary gravel fills, slightly above ditch base (Avery 1982, 14-15, fig. 7)	4780±40	−21.8	4810±25 T'=1.0; T'(5%)=3.8	3650–3520	*3650–3625* (*55%*) or *3580–3570* (*3%*) or *3560–3535* (*37%*)
OxA-15393	C2 (51) 4/B	Cattle. R radius articulating with ulna (2). Replicate of C2 (51) 4/A	From the same context as GrA-30942	4832±34	−21.3			
OxA-15395	C2 (51) 6	Sheep. 3 rib fragments from articulated skull, mandibles, ribs and vertebrae of a young individual (Cram 1982, 43)	From the same context as GrA-30942	4794±32	−21.2		3650–3520	*3650–3625* (*55%*) or *3580–3570* (*3%*) or *3560–3535* (*37%*)
GrA-30937	C2 (51) 3	Cattle. R radius articulating with ulna (1)	From the same context as GrA-30942	4805±40	−22.0		3660–3510	*3655–3625* (*55%*) or *3580–3570* (*3%*) or *3560–3535* (*37%*)

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
OxA-15396	C2 (11) 3	Cattle. Distal tibia fragment with fitting unfused epiphysis	Trench C2, pit C1, L11 in field, L45 in publication. Topmost surviving primary gravel fill, truncated by recut (Avery 1982, fig. 6)	4833±32	−21.7		3660–3530	*3645–3620* (*55%*) or *3580–3565* (*3%*) or *3560–3530* (*37%*)
BM-351	Charcoal no. 4 (AB, C2 : 27)	'As far as I can remember . . . the charcoal in samples 2, 3, 4 and 6 was obtained by collecting widely scattered and tiny fragments' (carbon of letter in Michael Avery's archive in Ashmolean). It is not clear of what the sample consisted, although charcoal from the layer was identified as *Quercus* sp. and *Pyrus* type (Western 1982)	Trench C2, pit C1, L27 in field, L13 in publication. A partly organic layer with much comminuted charcoal in the middle fills of a recut of ditch segment (Avery 1982, figs 4, 6)	5060±130			4230–3630	*4230–4200* (*1%*) or *4170–4125* (*2%*) or *4120–4095* (*1%*) or *4080–3635* (*91%*)
BM-352	Bone collagen no. 5 (AB, C2 ; 27)	Cattle. 1 of many animal bones. Described as '*Bos* horn & bone' in Michael Avery's archive in Ashmolean. Large bag of undated bones collected from BM 2005	From same context as sample for BM-351	4710±135			3770–3090	*3640–3590* (*54%*) or *3580–3555* (*5%*) or *3550–3530* (*36%*)
BM-350	Charcoal no. 3 (AB, C2 : 29)	'As far as I can remember . . . the charcoal in samples 2, 3, 4 and 6 was obtained by collecting widely scattered and tiny fragments' (carbon of letter in Michael Avery's archive in Ashmolean). It is not clear of what the sample consisted although charcoal identified from these layers was *Quercus* sp., *Acer* (prob. *campestre*), *Crataegus* or *Malus*, *Corylus avellana* and *Sorbus* cf. *aria* (Western 1982)	Trench C2, pit C1, L29 in field, L18a+L18b+L18C+L19a in publication. A partly organic backfill in the middle fills of a recut of ditch segment (Avery 1982, figs 4, 6)	4910±110			3960–3380	*3960–3595* (*94%*) or *3560–3540* (*1%*)
OxA-15399	C2 (36) 3	Cattle ?pubis fragment with unfused epiphysis. The recovery of the two elements from the same layer under the same find number suggests that they were still or recently joined by soft tissue when buried	Trench C2, pit C1, L36 in field, L15 in publication. One of upper fills in recut of ditch segment (Avery 1982, fig. 7)	4736±32	−21.3		3640–3370	*3635–3580* (*53%*) or *3575–3555* (*6%*) or *3550–3525* (*36%*)
GrA-30940	C2 (5) or (6) 9	Cattle. Distal tibia fragment articulating with astragalus (10)	Trench C2, pit C1, L5 or L6 in field, L6+L7 in publication. Some of upper fills of recut (Avery 1982, figs 6, 7)	4730±40	−21.6		3640–3370	*3635–3625* (*14%*) or *3615–3555* (*45%*) or *3545–3525* (*36%*)
GrA-30921	C2 (10) 23	Pig. Distal tibia fragment with fitting unfused epiphysis. The recovery of the two elements from the same layer under the same find number suggests that they were still or recently joined by soft tissue when buried	From same context as sample for BM-351	4700±35	−20.9		3640–3360	*3640–3595* (*54%*) or *3580–3555* (*5%*) or *3550–3530* (*36%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
GrA-30938	C2 (24) 5	Cattle. Ulna articulating with radius (7), from different animal to C2 (24) 18	Trench C2, pit C1, L24 in field, L5b in publication. One of upper fills of recut (Avery 1982, fig. 7)	4750±40	−22.1		3640–3370	*3635–3620* (*14%*) or *3605–3525* (*81%*)
BM-355	Antler protein no. 8 (AB, C2 : 4)	Red deer. Antler comb (Avery 1982, 42–43). Described as 'red deer antler incl. comb' in Michael Avery's archive in Ashmolean but listed by H. Case as comb in 1967 list of submissions to BM and described as such in text	Trench C2, pit C1, L4 in field, L3d in publication. An upper layer in the fill of the secondary recut (phase 2) of ditch segment (Avery 1982, figs 4, 7)	4460±140			3630–2770	
GrA-30934	C2 (4) 36/A	Cattle. Distal tibia fragment with fitting unfused epiphysis. Replicate of C2 (4) 36/B. From different animal to C1 (4) 17	Trench C2, pit C1, L4 in field, L3 in publication. Upper fill of recut (Avery 1982, figs 6, 7)	4760±40	−22.4	4816±25 T'=3.3; T'(5%)=3.8; ν=1	3650–3530	*3635–3620* (*14%*) or *3585–3520* (*81%*)
OxA-15397	C2 (4) 36/B	Replicate of C2 (4) 36/A	From the same context as GrA-30934	4854±33	−21.8			
GrA-30923	C1 (4) 17	Cattle. Distal tibia fragment with ?groove and splinter, articulating with astragalus from C2 4 (38). From different animal to C2 (4) 36/A & /B	From the same context as GrA-30934	4775±35	−21.5		3650–3380	*3635–3620* (*14%*) or *3585–3520* (*81%*)
OxA-15398	C2 (28+33B) 19	Cattle. Proximal metacarpal fragment, articulating with unciform (11), magnum (14), scaphoid (12) and lunate (10). From different animal to C2 (28+33B) 17	Trench C2, pit C2, L28+L33B in field, L20c in publication (Avery 1982, figs 7, 8)	4792±34	−21.6		3650–3510	*3640–3615* (*29%*) or *3610–3530* (*66%*)
GrA-31251	C2 (28+33B) 17	Cattle. Proximal metacarpal fragment, articulating with magnum (13). From different animal to C2 (28+33B) 19	Trench C2, pit C2, L28+L33B in field, L20c in publication. One of upper fills of recut (Avery 1982, figs 7, 8)	4785±30	−21.3		3650–3510	*3640–3615* (*28%*) or *3610–3525* (*67%*)
GrA-30933	C2 (33) 3	Cattle. Radius articulating with ulna (2)	Trench C2, pit C2, L33 in field, layers 17c+17d+17e in publication (Avery 1982, fig. 7)	4780±35	−21.6		3650–3380	*3635–3620* (*15%*) *or 3605–3525* (*80%*)
BM-353	Charcoal no. 6 (AB, C2 : 26)	'As far as I can remember. . . the charcoal in samples 2, 3, 4 and 6 was obtained by collecting widely scattered and tiny fragments' (carbon of letter in Michael Avery's archive in Ashmolean)	Trench C2, pit C2, L26 in field, L5d in publication. A partly organic layer in the upper fills of recut (phase 2) ditch segment. Possibly at similar horizon to sample for BM-355 (Avery 1982, figs 4, 8)	4970±130			4040–3380	*3995–3620* (*91%*) or *3610–3535* (*4%*)
BM-354	Bone collagen no. 7 (AB, C2 : 23A)	Cattle. 1 of several animal bones. Described as '*Bos* (horn & bone)' in Michael Avery's archive in Ashmolean. Large bag of undated bones collected from BM 2005	Trench C2, pit C2, L23A in field, L4c in publication. An upper layer in the fill of secondary recut (phase 2) of ditch segment (Avery 1982, figs 4, 6)	4450±145			3630–2700	
GrA-30936	C2 (26+23A) 14	Cattle. Proximal radius fragment, articulating with ulna (12)	Trench C2, pit C2, L26+L23A in field, L4b+L4c in publication. Some of upper fills of recut. (Avery 1982, figs 7, 8)	4775±40	−21.5		3650–3380	*3635–3620* (*14%*) or *3590–3520* (*81%*)

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
OxA-15394	C2 (24) 15	Cattle. Radius articulating with ulna (9), from different animal to C2 (24) 5. Note on certificate: OxA-15394 produced a lower yield than ideally required. We extracted 8.6 mg of collagen from 840 mg of bone powder. This is just under our 10 mb cut-off for acceptability'	From the same context as GrA-30938	4806±34	−21.1		3660–3520	*3635–3620* (*14%*) or *3600–3525* (*81%*)
Outer ditch								
GrA-30951	Abingdon layer 6 charcoal	1 fragment *Quercus* sp. sapwood	L6. Immediately overlying initial silts (Case 1956, fig. 2)	4890±35	−25.1		3720–3630	*3660–3630* (*55%*) or *3580–3570* (*3%*) or *3560–3535* (*37%*)
OxA-15405	Abingdon layer 4b charcoal	1 fragment *Prunus spinosa*	L4b. Above L5 and beneath L3A, interdigitating with L4 (Case 1956, fig. 2)	4822±34	−25.9		3660–3520	*3655–3620* (*49%*) or *3585–3530* (*46%*)
OxA-15404	Abingdon layer 4 charcoal A	1 fragment *Corylus* sp.	L4. Above L5 and beneath L3a (Case 1956, fig. 2)	4803±33	−26.1		3650–3520	*3650–3620* (*47%*) or *3605–3590* (*2%*) or *3585–3530* (*46%*)
GrA-31016	Abingdon layer 4 charcoal B	1 fragment *Corylus* sp.	From the same context as OxA-15404	4810±35	−25.6		3660–3520	*3650–3620* (*48%*) or *3600–3590* (*1%*) or *3585–3530* (*46%*)
OxA-15403	Abingdon layer 3a charcoal A	1 fragment *Quercus* sapwood	L3a. Above L4 and beneath L3 (Case 1956, fig. 2)	4787±34	−26.1		3650–3510	*3640–3615* (*24%*) or *3610–3525* (*71%*)
GrA-31003	Abingdon layer 3a charcoal B	1 fragment *Prunus spinosa*	From the same context as OxA-15403	4770±40	−25.8		3650–3370	*3640–3550* (*57%*) or *3545–3525* (*38%*)
OxA-15402	Abingdon layer 3 charcoal A	1 fragment *Prunus spinosa*	L3. Above L3A and beneath L2A (Case 1956, fig. 2).	4756±32	−24.5		3640–3370	*3635–3620* (*14%*) or *3600–3520* (*81%*)
GrA-31017	Abingdon layer 3 charcoal B	1 fragment *Prunus spinosa*	From the same context as OxA-15402	4760±35	−24.7		3640–3370	*3635–3620* (*14%*) or *3600–3520* (*81%*)

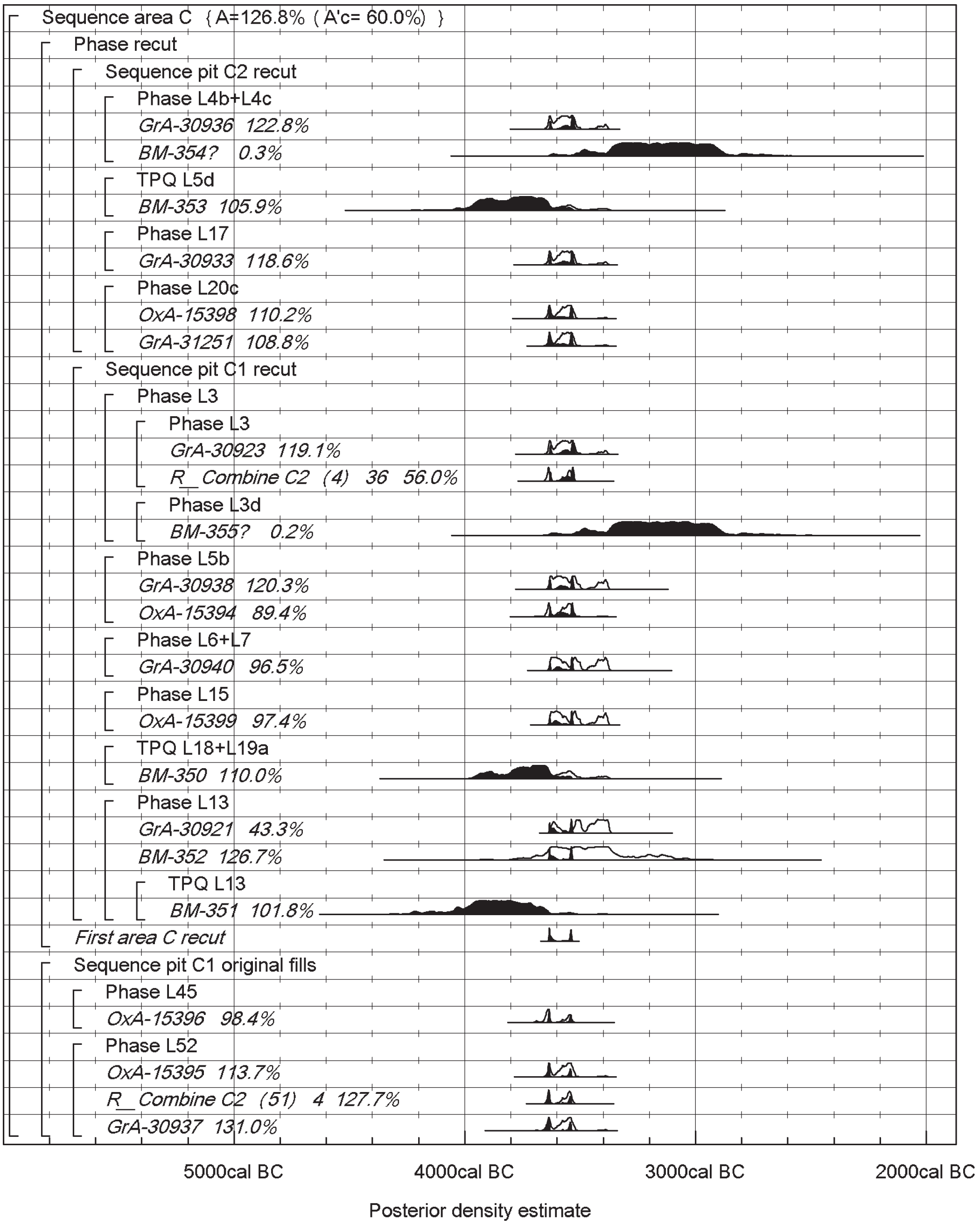


Fig. 8.20. Abingdon. Probability distributions of dates from the inner ditch in area C. The format is identical to that of Fig. 8.3. The overall structure of this model is shown in Fig. 8.18, and its other components in Figs 8.19 and 8.21.

Results and calibration

Full details of the radiocarbon results from the site are provided in Table 8.5.

Analysis and interpretation

The overall structure of the chronological model for the enclosure is shown in Fig. 8.18, with its component sections in Figs 8.19–21.

The inner ditch. In area B, no samples were available from below the recut. From the bottom layer of the recut, the context of *BM-348*, two short-life charcoal fragments were measured (Fig. 8.19: *GrA-30949, OxA-15400*). These three measurements are statistically consistent (T'=0.2; T'(5%)=6.0; ν=2), supporting Avery's impression that the sample for *BM-348* was twiggy. From the upper fill of the recut, *BM-349* was augmented by an articulating bone sample (Fig. 8.19: *GrA-30922*) and by two short-life charcoal samples (Fig. 8.19: *OxA-15401* and *GrA-30948*). The short-life material from this layer provided measurements statistically consistent with the articulating sample, suggesting that all three were freshly deposited (T'=0.0; T'(5%)=6.0; ν=2).

In area C, one articulated (Fig. 8.20: *OxA-15395*) and two articulating animal bone samples (Fig. 8.20: *C2* (*51*) *4* and *GrA-30937*) were dated from a lens close to the base of the original fills. These three samples provided statistically consistent radiocarbon measurements (T'=0.2; T'(5%)=6.0;

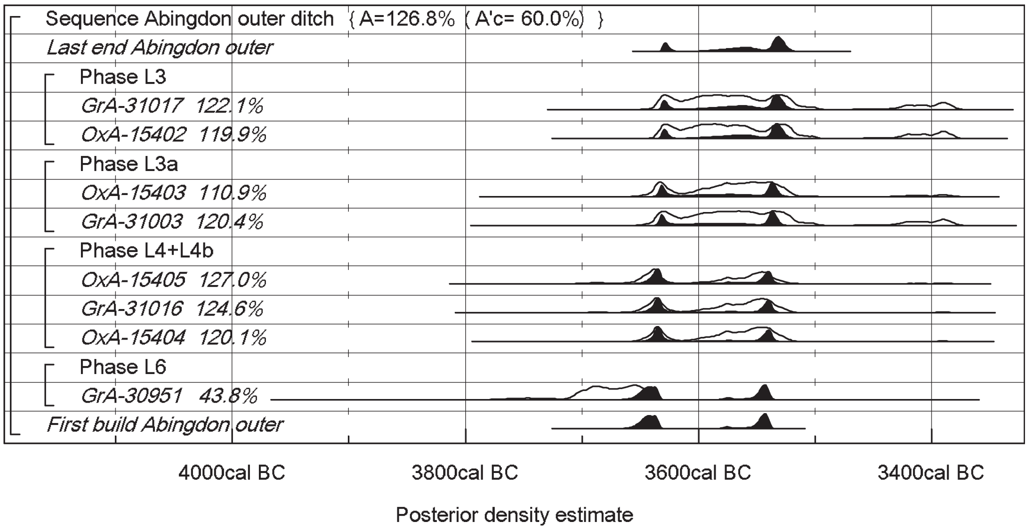


Fig. 8.21. Abingdon. Probability distributions of dates from the outer ditch. The format is identical to that of Fig. 8.3. The overall structure of this model is shown in Fig. 8.18, and its other components in Figs 8.19–20.

ν=2). A fitting sample (Fig. 8.20: *OxA-15396*) came from the topmost surviving layer of the original fills.

Two deeper parts of the segment excavated here, known as pits C1 and C2, may have been separate until joined by the recut (Avery 1982, fig. 7). While the recut is continuous across them, the stratigraphy over one is difficult to relate precisely to that over the other. They are therefore treated in the model as two separate sequences within the recut (Fig. 8.20). Layer 13 of pit C1, at the base of the recut (Fig. 8.15), yielded a fitting animal bone sample (*GrA-30921*) which produced a measurement consistent with that on the disarticulated animal bone sample, *BM-352* (T'=0.0; T'(5%)=3.8; ν=1), supporting the interpretation of this sample as freshly deposited. For this reason, it has been included in the model, although *BM-351*, an unidentified bulk charcoal sample, simply provides a *terminus post quem* for the layers above. Above this, a further *terminus post quem* is provided by *BM-350*. A series of articulating bones and bones with fitting unfused epiphyses provide a sequence of samples from the overlying fills. All these measurements show good agreement with this stratigraphic sequence (Fig. 8.20). In contrast, BM-355, on an antler comb, appears to be anomalously late for the layer from which it was recovered. This measurement has been excluded from the model, since it is perfectly feasible that younger contaminants were incompletely removed from a probably relatively small collagen sample measured in the late 1960s.

In pit C2, the lowest samples (Fig. 8.20: *OxA-15398* and *GrA-31251*) came from roughly half way up the recut fills. These measurements on articulating animal bone are statistically consistent (T'=0.0; T'(5%)=3.8; ν=1). Two samples (*GrA-30933*, *-30936*) of articulating bone from overlying layers provide measurements which are in good agreement with their stratigraphic positions. An unidentified charcoal sample (*BM-353*) from an intervening layer is included as a *terminus post quem*, but BM-354, a disarticulated animal bone sample, has been excluded from the model because, like BM-355, it appears anomalously recent for its context.

This model suggests that the inner circuit was constructed in *3655–3630 cal BC* (*55% probability*; Fig. 8.18: *build Abingdon inner*) or *3580–3570 cal BC* (*3% probability*) or *3560–3535 cal BC* (*37% probability*), probably in the *3640s or 3630s cal BC* (*44% probability*) or the *3540s cal BC* (*24% probability*).

The outer ditch. Case recorded that 'charcoal was very occasionally found in L2a, but, below it was common in all layers down to 6, quite often occurring in patches about 6 in. [0.15 m] to 1 ft. [0.30 m] square, as though possibly thrown in a damp cohesive mass' (1956, 18). A series of eight short-lived charcoal fragments were dated from four successive stratigraphic levels (Fig. 8.21). All these measurements are in good agreement with the stratigraphic sequence, and are statistically consistent (T'=11.1; T'(5%)=14.1; ν=7), suggesting that the gravel fills accumulated rapidly. This is not unexpected in a ditch cut in gravels.

This model suggests that the outer circuit was constructed in *3660–3630 cal BC* (*55% probability*; Fig. 8.21: *build Abingdon outer,*) or *3580–3570 cal BC* (*3% probability*) or *3560–3535 cal BC* (*37% probability*), probably in *the 3640s or 3630s cal BC* (*42% probability*) or in *3550–3535* cal BC (*26% probability*).

Implications for the site

Figure 8.22 shows the posterior density estimates for the construction of both ditches at Abingdon and the recutting of the inner one. All these probability distributions are strongly bimodal, suggesting that the earthworks were constructed and in use either during the third quarter of the 37th century cal BC or during the third quarter of the 36th century cal BC.

Examination of the differences between these estimates

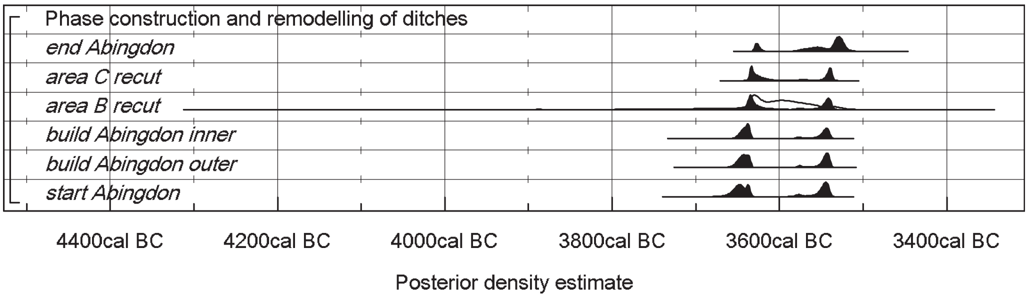


Fig. 8.22. Abingdon. Posterior density estimates for the construction and remodelling of the ditches at Abingdon, derived from the model shown in Figs 8.18–21.

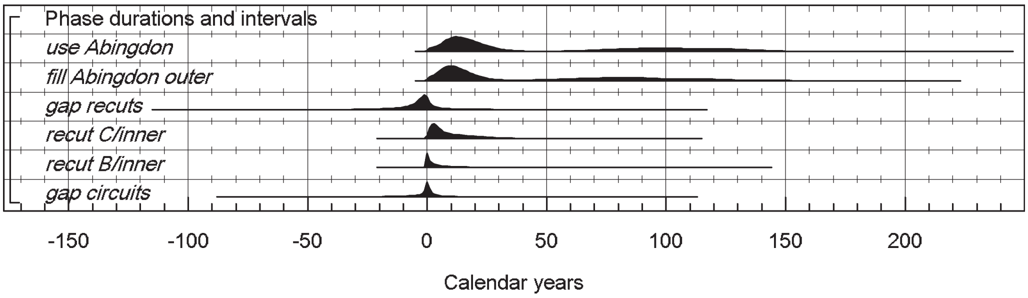


Fig. 8.23. Abingdon. Probability distributions of the number of years between key parameters at Abingdon, derived from the model shown in Figs 8.18–21.

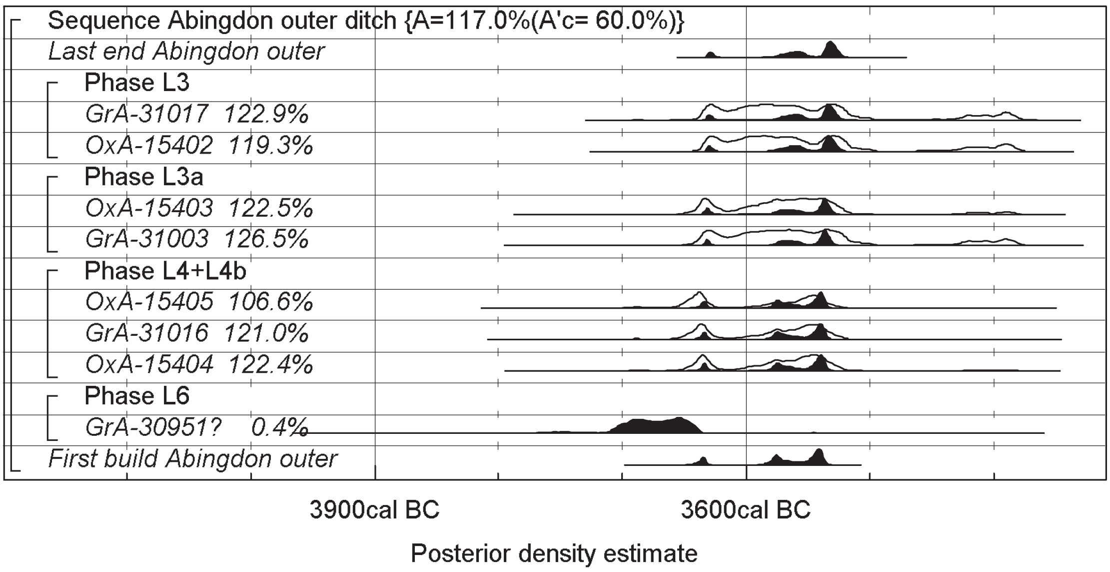


Fig. 8.24. Abingdon. Probability distributions of dates from the outer ditch according to the alternative model which excludes GrA-30951 as residual. The overall structure of this model is given in Fig. 8.18, and the structures of the other component sections are shown in detail in Figs. 8.19–20 (although the posterior density estimates shown on these figures are not those relating to this model). The format is identical to that of Fig. 8.3. The large square brackets down the left-hand side of Figs 8.18–20 and this figure, along with the OxCal keywords, define the overall model exactly.

provides indications of the number of years between the events concerned (Fig. 8.23). The difference between the construction dates of the inner and outer circuits is *−15–10 years* (*95% probability*; Fig. 8.23: *gap circuits*), probably *−3–4 years* (*68% probability*). This means that, although we do not know the relative order in which the two circuits were built, they were constructed within a few years of each other and may be precisely contemporary – built in the same season. This result is at variance with Michael Avery's hypothetical sequence, in which the inner circuit was decommissioned when the outer was built (1982, 12, 24) and in accord with Richard Bradley's alternative view of two contemporary but functionally distinct circuits (1992).

The interval between the initial construction of the inner circuit and its recutting as evidenced in area B is

estimated at *0–35 years* (*95% probability*; Fig. 8.23: *recut B/inner*), probably *within a decade* (*68% probability*). The equivalent interval as evidenced in area C is estimated to be *0–30 years* (*95% probability*; Fig. 8.23: *recut C/inner*), probably *within 15 years* (*68% probability*).

The chronological model estimates the recut in area B to have occurred in *3655–3600 cal BC* (*53% probability*; Fig. 8.19: *area B recut*) or *3580–3530 cal BC* (*42% probability*), probably in *3645–3620 cal BC* (*38% probability*) or *3550–3535* (*30% probability*). In area C, the recut is estimated to have occurred in *3640–3605 cal BC* (*55% probability*; Fig. 8.20: *area C recut*) or *3580–3560 cal BC* (*4% probability*), or *3555–3530* (*36% probability*), probably in *3640–3620 cal BC* (*39% probability*) or *3545–3535* (*29% probability*).

From these results it is perfectly feasible that the recuts in areas B and C were precisely contemporary and formed a single event. On the other hand, it is not possible to exclude the possibility of more than one episode of recutting. If so, however, these occurred within *−30–25 years* (*95% probability*; Fig. 8.23: *gap recuts*), probably within *−10–5 years* (*68% probability*).

Overall, it is probable that both circuits at Abingdon and the dated recut(s) in the inner ditch all occurred within a decade.

As far as can be inferred from a single narrow section, the outer ditch was not recut, so that the difference between our estimate for when the ditch was cut and the latest sample (from layer 3: Fig. 8.15) suggests that gravel fills had accumulated almost to the ditch top by *3635–3620 cal BC* (*14% probability*; Fig. 8.21: *end Abingdon outer*) or *3595–3515 cal BC* (*81% probability*), probably by *3635–3620 cal BC* (*12% probability*) or *3570–3550 cal BC* (*14% probability*) or *3540–3520* (*42% probability*). These fills accumulated within *0–30 years* (*57% probability*; Fig. 8.23: *fill Abingdon outer*) or *45–125 years* (*38% probability*), probably within *0–25 years* (*55% probability*) or *70–90 years* (*13% probability*).

Similar estimates are not possible for the inner ditch because of recutting. The best estimate for the overall use of this circuit is therefore provided by the estimate for the overall use of the Neolithic enclosure. The model suggests that material was deposited in the ditches for between *0–40 years* (*57% probability*; Fig. 8.23: *use Abingdon*) or *65–145 years* (*38% probability*), probably for between *0–30 years* (*54% probability*) or *85–110 years* (*14% probability*).

The sorts of intervals and durations illustrated in Fig. 8.23 suggest that it is unlikely that the use of the enclosure falls on both peaks of the bimodal probability distribution shown in Fig. 8.22. The enclosure was built and used either during the first peak in the third quarter of the 37th century cal BC or during the second peak in the third quarter of the 36th century cal BC.

Some sensitivity analyses

The model described above has good overall agreement ($A_{overall}$=126.8%; Figs 8.18–21), and so the radiocarbon dates are compatible with the archaeological information included in this model. It should be noted, however, that, although convergence is satisfactory for the analysis reported above (C=99.2%; Bronk Ramsey 1995), it is possible for the MCMC sampler in OxCal v3.10 to get trapped on the earlier peak. In this case the model is unstable and the convergence is poor (C < 95%). Such solutions are unreliable and should not be reported. All stable solutions in which the convergence threshold is met produce date estimates for the Abingdon enclosure which are bimodal, and durations which are short.

It is difficult to manufacture a more plausible model for the chronology of the Abingdon enclosure, and indeed it is not necessary to do so as the model defined in Figs 8.18–21 does have good overall agreement. In order to investigate the difficulty the sampler has in achieving a stable solution, however, a series of further models have been constructed to explore this technical issue.

Three samples have marginally poor agreement in the Abingdon model: *C2* (*4*) *36* and *GrA-30921* from the recut of the inner ditch in area C (A=56.0% and A=43.3% respectively; Fig. 8.20), and *GrA-30951* in layer 6 in the outer ditch (A=43.8%; Fig. 8.21).[2] Together these indices do not lower the overall agreement index undesirably and, in a model with such informative prior information, they are not noteworthy. *C2* (*4*) *36* and *GrA-30921* are both animal bones with fitting epiphyses, and *GrA-30951* was a single fragment of *Quercus* sp. sapwood. If we are determined to exclude one of these results from the model, then *GrA-30921* is probably the most plausible candidate on archaeological grounds as a single fragment of charcoal can always be residual. Examination of the likelihoods of the calibrated radiocarbon dates also suggests that this result may be causing the poor convergence, as it is very unlikely to fall in the later mode of the solution (0.4% probable; Fig. 8.24).

Figure 8.18 provides the overall structure of an alternative model for the chronology of the Abingdon enclosure, with the structures of the component sections shown in Figures 8.19–20 and 8.24. The likelihoods included in this model are shown in these figures, although only the posterior density estimates shown on Figure 8.24 relate to this model. In this interpretation, Figure 8.24 replaces Figure 8.21 as the component relating to the outer ditch, excluding GrA-30951 from the analysis as reworked. This model also has good overall agreement and satisfactory convergence ($A_{overall}$=117.0%; C=98.5%). The posterior density estimates for the construction and remodelling of the ditch at Abingdon are still bimodal, although now the balance of probability has shifted from a date in the 3630s cal BC to one in the mid-36th century cal BC (Fig. 8.25).

The overall structure for a third chronological model for the Abingdon enclosure is shown in Fig. 8.26, with the structures of the component sections shown in Figs 8.19–20 (although the posterior density estimates shown on these figures are not those relating to this model). This model also has good overall agreement and satisfactory convergence ($A_{overall}$=123.4%; C=98.9%), and again bimodal distrib-

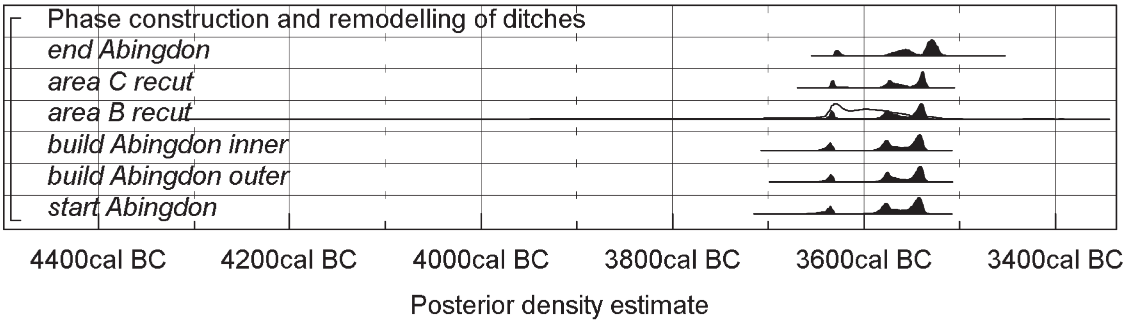


Fig. 8.25. Abingdon. Posterior density estimates for the construction and remodelling of the ditches, derived from the alternative model defined in Figs 8.18–20 and 8.24.

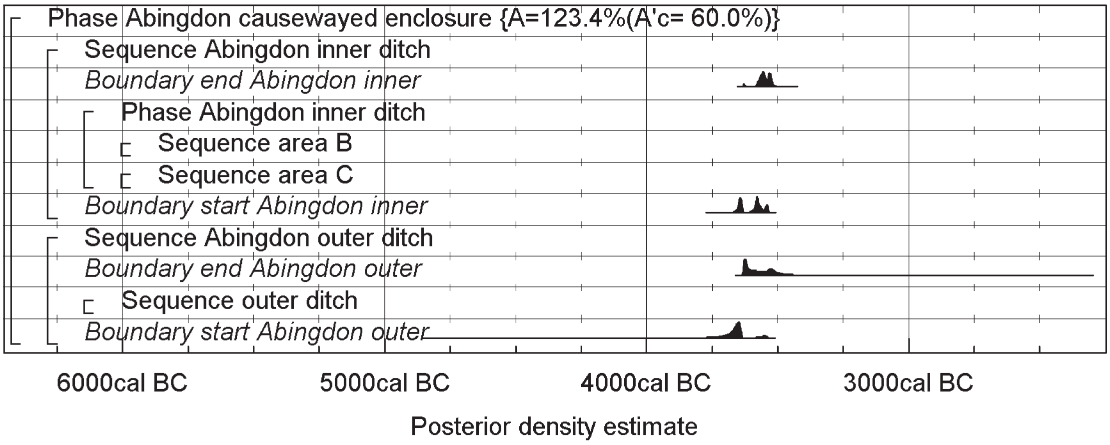


Fig. 8.26. Abingdon. Overall structure of another alternative chronological model for the enclosure sequence. The structures of the component sections of this model are shown in detail in Figs. 8.19–21 (although the posterior density estimates shown on these figures are not those relating to this model). The large square brackets down the left-hand side of Figs 8.19–21 and this figure, along with the OxCal keywords, define the overall model exactly.

utions are produced. In this case the date of the inner ditch within the 37th or 36th century cal BC is still uncertain (although a longer period of use is slightly more probable; *60–130 years at 32% probability*; distribution not shown). In contrast, the construction and use of the outer ditch are much more liable to fall in the middle decades of the 37th century according to this interpretation, although these distributions are also slightly bimodal (Fig. 8.26).

This model assumes that the construction and use of each circuit were completely independent, and that they did not form part of a unitary enclosure. In this model, the probability that the outer circuit is earlier than the inner is 89%. We feel, however, that this interpretation may be less convincing, because that kind of development – with a smaller inner circuit in effect replacing an original outer and larger layout – seems not to be repeated elsewhere, and because it seems unlikely that two enclosures were built in this space with absolutely no reference to each other. The general pattern is of elaboration around a central core (C. Evans 1988b). This alternative model is no more statistically probable than the model described in detail above which treats the enclosure as a unitary whole (Figs 8.18–21). As we feel this to be archaeologically more plausible, it is that model which we discuss further.

8.6 Implications for the upper Thames

Although later Mesolithic finds have been recovered in the Upper Thames catchment (Holgate 1988a), there has been little evidence until recently of Neolithic activity predating the construction of the Abingdon causewayed enclosure. Excavations on the Thames floodplain at Yarnton, however, have revealed a Neolithic and Bronze Age landscape which includes an early Neolithic rectangular structure (Hey *et al.* 2003, 81–2, fig. 8.3) dating perhaps to the late 39th or 38th century cal BC (Fig. 8.27: structure 3871; Hey *et al.* 2003, fig. 8.3). Datable material from this structure was extremely limited and it was only possible to obtain four radiocarbon measurements. Formal modelling of these dates suggests that the building was constructed in *4390–3765 cal BC* (*95% probability*; Fig. 8.27: *start_3871*), probably in *4000–3805 cal BC* (*68% probability*), and was in use until *3915–3235 cal BC* (*95% probability*; Fig. 8.27: *end_3871*), probably until *3780–3590 cal BC* (*68% probability*). The number of determinations is obviously insufficient to provide a reliable indication of the amount of statistical scatter on these dates, and so these estimates must be treated with caution. Contemporary features include a finds scatter (which is probably a disturbed midden), an adjacent pit (2349) with cereals, and tree-throw holes. This phase of activity predated the construction of the

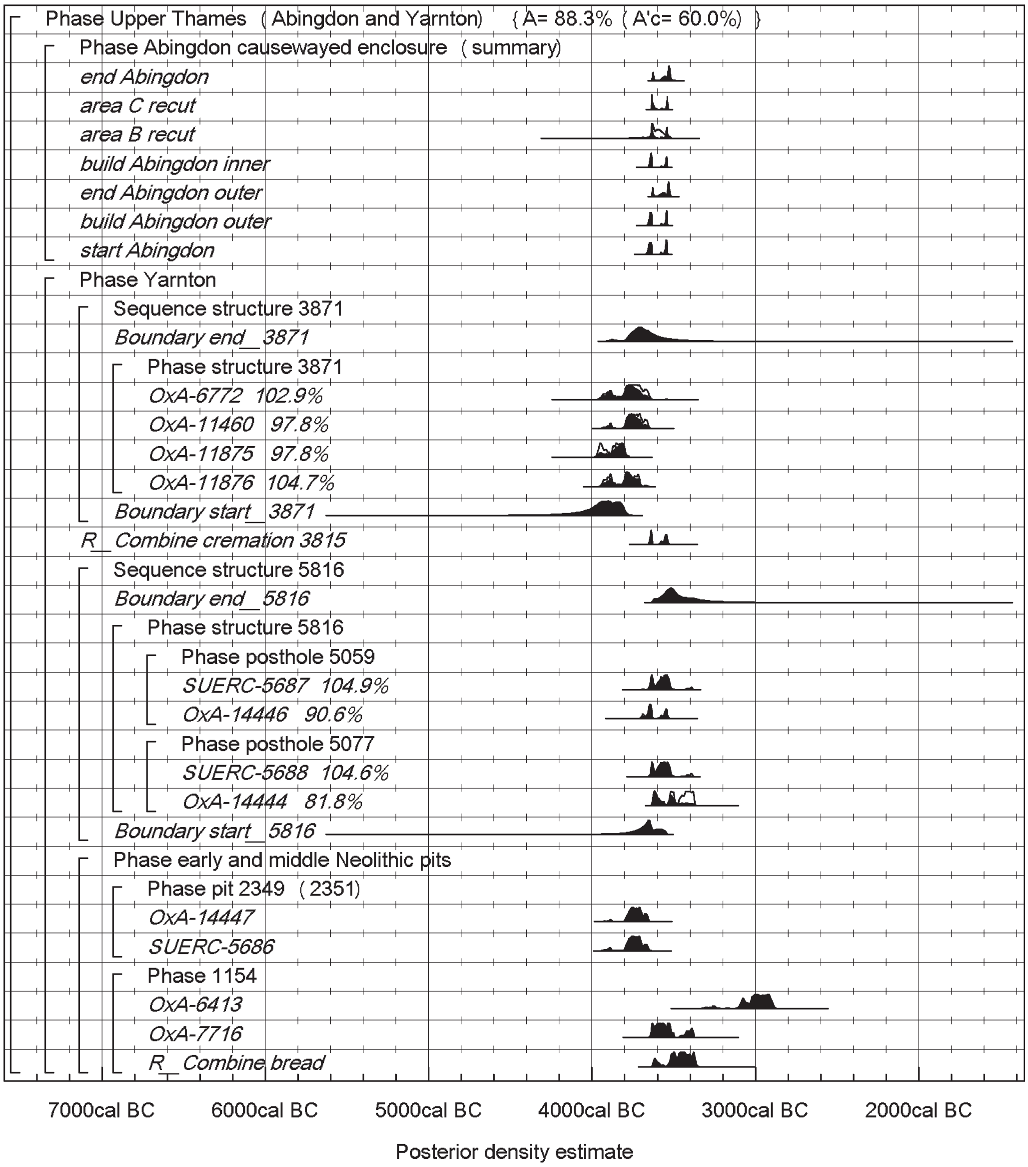


Fig. 8.27. Abingdon and Yarnton. Probability distributions of dates from the causewayed enclosure, derived from the model shown in Figs 8.18–21, and from Neolithic activity. The format is identical to that of Fig. 8.3. The model for Yarnton is defined exactly by the brackets down the left-hand side of the diagram.

Abingdon causewayed enclosure by at least a century or so (Fig. 8.27).

The floodplain at Yarnton continued to be used through the Neolithic, and a circular building (structure 5816), a human cremation (*cremation 3815*) next to the rectangular structure, and a pit (1154) containing carbonised bread appear to be broadly contemporary with the use of the Abingdon enclosure (Fig. 8.27). The New Wintles Farm monument has no radiocarbon dates, but the plan and finds, including a rim fragment from a decorated Bowl, suggest that it was also in use in the first half of the fourth millennium cal BC (Kenward 1982). Some elements of the flint scatters identified by Robin Holgate (1988a) are also likely to represent early activity. Otherwise, there is very little known activity contemporary with the numerous causewayed enclosures upstream of Abingdon. The potential of the second gravel terrace higher up the valley may be reflected in the discovery of 20 pits, diversely containing plain Bowl, Peterborough Ware and Grooved Ware, during the excavation of 5.5 ha in advance of gravel quarrying at Fairford, Gloucestershire, among the Down Ampney, East Leach, Langford and Broadwell enclosures (Lamdin-Whymark 2003). Further sites like Yarnton may also be sealed beneath the alluvium of the floodplain and thus difficult to detect.

Downstream from Abingdon, pits have been encountered above the floodplain. At Benson, more than 40 pits, postholes and other features contained Bowl pottery, in a few cases light-rimmed, open, carinated forms, but in most instances comparable with the Abingdon assemblage (Pine and Ford 2003). Charred hazelnut shells from two of the pits with Abingdon-like pottery are dated to the mid-fourth millennium cal BC (Fig. 8.28: *KIA-9530–1*). Farther downstream again, at South Stoke, close to the Goring

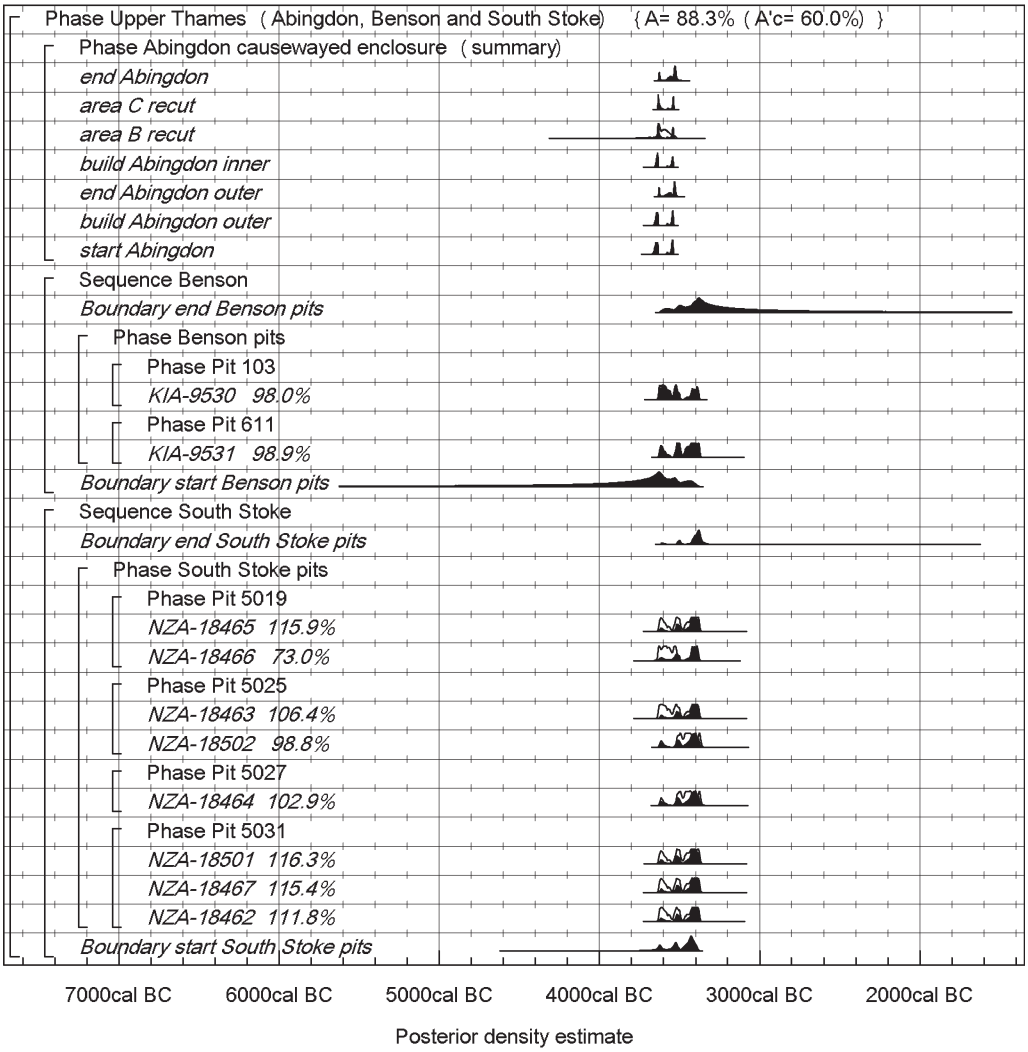


Fig. 8.28. Abingdon, Benson and South Stoke. Probability distributions of dates from the causewayed enclosure, derived from the model shown in Figs 8.18–21, and from Neolithic pits. The format is identical to that of Fig. 8.3. The models for Benson and South Stoke are defined exactly by the brackets down the left-hand side of the diagram.

Gap, a cluster of seven pits contained another Abingdon-like pottery assemblage (Timby *et al.* 2005, 228–39, 261–8). Eight samples of charred hazelnut shell from four of them are dated to the mid-fourth millennium cal BC (Fig. 8.28; Table 8.6). All eight are statistically consistent (T'=3.2; T'(5%)=14.1; ν=7). They are also statistically consistent with the two dates from pits at Benson (T'=4.1; T'(5%)=16.9; ν=9). The relatively brief use of the Abingdon enclosure could have coincided with the placement of finds in these pits. The period of deposition at both South Stoke and Benson, however, could have been comparatively brief, so it is also possible that we are looking at the activity of different generations of people. Further measurements are required from both these sites if a comparable level of precision to that available for the Abingdon enclosure is to be achieved for the pit sites.

The Abingdon enclosure lay within a landscape in which tree clearance appears to have already begun at some point after *4330–3900 cal BC* (*87% probability*; Fig. 8.29: *OxA-4559*) or *3880–3795 cal BC* (*8% probability*), the date for wood and seeds from clay at the base of a pollen sequence from Daisy Banks Fen immediately to the south-east (Parker 1999). Molluscs from the inner ditch of the enclosure indicated a calcareous, open, well-drained grassland habitat (Cain 1982). The only dated feature in the immediate vicinity which may be earlier than the enclosure is a deep pit at Barrow Hills, Radley, over which a mortuary feature was later placed (Barclay and Halpin 1999, 28–31). An antler in the bottom of this pit yielded a radiocarbon date of 4240–3700 cal BC (95% confidence; Table 8.6: OxA-1881). The dates obtained from the three burials above it were, however, much later than the antler, and also post-dated the causewayed enclosure (Fig. 8.29: *BM-2709, -2714, -2716*). These measurements are not statistically consistent (T'=7.8; T'(5%)=6.0; ν=2), suggesting that the individuals were interred successively. Two of three individuals buried in single flat graves nearby were interred in the mid-fourth millennium cal BC, and were contemporary with or later than the enclosure (Fig. 8.29: *OxA-1882, -4359*). The earliest material dated from

Table 8.6. Radiocarbon dates from Yarnton Floodplain; Daisy Banks Fen; Barrow Hills; the Drayton cursus; St Helen's Avenue, Benson; the North Stoke bank barrow; the Dorchester-on-Thames cursus; Mount Farm, Berinsfield; and South Stoke (all Oxfordshire). Posterior density estimates derive from the models defined in Figs 8.27–9.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**$\delta^{15}N$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Yarnton Floodplain									
NZA-8679	YFP92 1154d	Carbonised 'bread'	Bottom fill of pit 1088	4672 ± 57	−22.8		4673±44	3630–3360	*3630–3585* (*10%*) or *3530–3360* (*85%*)
OxA-6412	YFP92 1154a	Replicate of NZA-8679	From the same context as NZA-8679	4675 ± 70	−22.5		T'=0.0; T'(5%)=3.8; ν=1		
OxA-7716	YFP92 1154c	Charred hazelnut shells	From the same context as NZA-8679	4760 ± 45	−24.0			3650–3370	*3645–3495* (*78%*) or *3440–3375* (*17%*)
OxA-6413	YFP92 1154b	Charred hazelnuts	From the same context as NZA-8679	4355 ± 55	−24.0			3270–2880	*3265–3235* (*2%*) or *3110–2880* (*93%*)
SUERC-5686	YFP92 2351b	Indeterminate cereal grain	Primary fill of pit 2349	4965±35	−23.7			3900–3650	*3895–3875* (*2%*) or *3800–3650* (*93%*)
OxA-14447	YFP92 2351a	*Triticum dicoccum* or *spelta* grain	From the same context as SUERC-5686	4957±34	−23.9			3800–3650	*3800–3650*
OxA-14444	YFP92 5077b	Carbonised nutshell, *Corylus avellana*	Circular structure 5816. Postpipe 5077 in posthole 5076	4700±33	−22.7			3640–3370	*3635–3550* (*51%*) or *3540–3490* (*27%*) or *3470–3380* (*17%*)
SUERC-5688	YFP92 5077a	*Triticum dicoccum* or *spelta* grain	From the same context as OxA-14444	4780±35	−23.5			3650–3380	*3645–3515*
OxA-14446	YFP92 5060b	Pomoideae charcoal	Circular structure 5816. Postpipe 5060 in posthole 5059	4850±33	−23.7			3700–3530	*3695–3625* (*55%*) or *3585–3530* (*40%*)
SUERC-5687	YFP92 5060a	Carbonised hazelnut shell,	From the same context as OxA-14446	4795±40	−27.3			3660–3380	*3650–3520*
OxA-14479	YFPB96 3814a	Human. Calcined bone	Cremation deposit in top of pit 3815	4867±35	−23.0		4822±25	3660–3530	*3655–3625* (*39%*) or *3585–3525* (*56%*)
SUERC-5689	YFPB96 3814b	Replicate of OxA-14479	From the same context as OxA-14479	4775±35	−22.8		T'=3.5; T'(5%)=3.8; ν=1		
OxA-11875	YFPB96 3920 5011a	*Quercus* sp. sapwood charcoal	Rectangular structure 3871, context 3920, which forms the central postpipe of the large postpit 3923	5097±36	−23.2			3980–3790	*3965–3780*
OxA-11876	YFPB96 3920 5011b	*Quercus* sp. sapwood charcoal	From the same context as OxA-11875	5006±36	−23.4			3950–3700	*3940–3855* (*25%*) or *3845–3830* (*1%*) or *3825–3700* (*69%*)
OxA-11460	YFPB96 4579 5303	Charred *Arrenatherum elatius* tuber	Rectangular structure 3871, context 4579, packing in postpit 4580	4960±40	−26.5			3910–3690	*3915–3875* (*8%*) or *3805–3655* (*87%*)
OxA-6772	YFPB86 4574	Pomoideae charcoal	Rectangular structure 3871. Postpipe 4574 in postpit 4580	4970±60	−24.4			3950–3640	*3935–3855* (*18%*) or *3845–3655* (*77%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Daisy Banks Fen									
OxA-4559	DBF 1	Wood and seeds	Clay at base of pollen sequence in immediate vicinity of Abingdon causewayed enclosure, at depth of 980–1000 mm, preceding clearance episode within local pollen zone 1 (Parker 1999)	5240±110	−28.7			4340–3790	*4330–3900* (*87%*) or *3880–3795* (*8%*)
Barrow Hills									
OxA-1881		Red deer. Antler	F5352. Pit central to and underlying linear mortuary feature (Barclay and Halpin 1999, 28–31, figs 3.6–8)	5140±100	−21.0 (estimated)			4240–3700	*4230–4195* (*3%*) or *4175–3705* (*92%*)
BM-2716		Human. Long bone from articulated skeleton of adult male	F5352, burial A. Most complete burial in mortuary feature, at W end (Barclay and Halpin 1999, 28–31, fig 3.5)	4600±70	−20.5			3630–3090	*3630–3595* (*2%*) or *3530–3095* (*93%*)
BM-2714		Human. Femur, tibia and fibula from disarticulated but substantially complete ageing adult female	F5352, burial B. In centre of mortuary feature (Barclay and Halpin 1999, 28–31, fig. 3.5)	4470±70	−19.0			3370–2910	*3360–3000* (*87%*) or *2995–2925* (*8%*)
BM-2709		Human. Femur and tibia from partly articulated and substantially complete adult female	F5352, burial C. At E end of mortuary feature (Barclay and Halpin 1999, 28–31, fig. 3.5)	4270±100	−20.6			3270–2570	*3325–3230* (*3%*) or *3120–2570* (*92%*)
OxA-1882		Human. Articulated burial of 10–12 year-old child	F5354. Flat grave clustered with F5356, F5355 (Barclay and Halpin 1999, 31–4, figs 3.9–10)	4650±80	−21.0 (estimated)			3640–3100	*3640–3310* (*84%*) or *3240–3105* (*11%*)
BM-2710		Human. Femur from 40–45 year-old male	F5355. Flat grave clustered with F5354, F5356 (Barclay and Halpin 1999, 31–4, figs 3.9–10)	4530±50	−20.1			3490–3020	*3100–2885*
OxA-4359		Human. Femur and tibia from disturbed, originally articulated burial, perhaps of adult female	F5356. Flat grave clustered with F5354, F5352 (Barclay and Halpin 1999, 31–4, figs 3.9–10)	4700±100	−21.1			3660–3120	*3665–3310* (*88%*) or *3240–3105* (*7%*)
BM-2392		Red deer. Antler beam and tine	Oval barrow. Base of phase 3 ditch (Bradley 1992, 130–2, 134, fig. 4; Barclay and Halpin 1999, 19–26, figs 3.2–3)	4500±60	−20.0			3370–2930	*3365–3020*
BM-2390		Red deer. Antler, beam fragment and part of tine	Oval barrow. Middle fill of phase 4 ditch at a higher level than sample for BM-2393 (Bradley 1992, 132, 134, fig. 4; Barclay and Halpin 1999, 19–26, figs 3.2–3)	4320±130	−20.6			3360–2570	*3290–2895*
BM-2393		Red deer. Antler, base of tines	Oval barrow. Middle fill of phase 4 ditch at a lower level than sample for BM-2390 (Bradley 1992, 132, 134, fig. 4; Barclay and Halpin 1999, 19–26, figs 3.2–3)	4420±70	−22.1			3360–2890	*3285–3210* (*8%*) or *3195–2915* (*87%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
BM-2391		Red deer. Antler, base and brow tines	Oval barrow. Lowest fill of phase 5 ditch (Bradley 1992, 132, 135, fig. 4; Barclay and Halpin 1999, 19–26, figs 3.2–3)	4330±80	−21.8			3330–2710	*3115–2845* (*91%*) or *2815–2745* (*4%*)
BM-2707		Human. Femur and tibia from articulated burial of adult male. May have been subject to humic acid contamination (Ambers *et al.* 1999, 331)	Oval barrow. Burial 2127, in same grave as burial 2708 (Bradley 1992, 132, fig. 5; Barclay and Halpin 1999, 19–26, figs 3.2–3)	4120±60	−19.9				
BM-2708		Human. Long bone from articulated burial of adult female. May have been subject to humic acid contamination (Ambers *et al.* 1999, 331)	Oval barrow. Burial 2708, in same grave as burial 2127 (Bradley 1992, 132, fig. 5; Barclay and Halpin 1999, 19–26, figs 3.2–3)	3860±50	−23.0				
BM-2712	L611/A/13	Red deer. Antler pick	Ring ditch 611. Layer 13, with other antler implements in primary fill, stratified above sample for BM-2713 (Barclay and Halpin 1999, figs 4.1, 4.3)	3860±80	−22.8			2570–2040	
BM-2713	L611/A/14	Red deer. Antler pick	Ring ditch 611. Layer 14, with other antler implements and some articulated animal bone near ditch base, stratified below sample for BM-2712 (Barclay and Halpin 1999, figs 4.1, 4.3)	3950±80	−20.7			2840–2200	
Drayton									
OxA-2074		Charcoal, mainly Pomoideae	405. Soil beneath E cursus bank (A. Barclay *et al.* 2003, 181)	4620±80	−28.8			3640–3090	*3655–3515* (*94%*) or *3455–3415* (*1%*)
OxA-2073		*Corylus* and *Fraxinus* charcoal and hazel nutshell fragments	412/B/1. Treehole beneath cursus bank (A. Barclay *et al.* 2003, 62–7, 180–5)	4800±100	−26.5			3790–33670	*3700–3515* (*94%*) or *3440–3410* (*1%*)
HAR-6478		Animal bone. Bulk sample	1004/7(F4/7). Base of cursus ditch (A. Barclay *et al.* 2003, 67–83, 180–5 fig. 4.26)	4780±100	−19.0 (assumed)			3770–3350	*3635–3485* (*89%*) or *3435–3375* (*6%*)
OxA-2071		Slightly singed waterlogged bark	From the same context as HAR-6478	4810±70	−26.0			3710–3370	*3625–3495* (*90%*) or *3430–3380* (*5%*)
HAR-6477		Animal bone. Bulk sample	From the same context as HAR-6478	4990±100	−19.0 (assumed)			3980–3530	*3620–3505* (*90%*) or *3430–3380* (*5%*)
St Helen's Avenue, Benson									
KIA-9530		Charred hazelnut shell	Pit 103, context 153. Associated with decorated Bowl pottery akin to assemblage from Abingdon causewayed enclosure (Pine and Ford 2003)	4736±32	−26.0			3640–3370	*3635–3495* (*67%*) or *3440–3375* (*28%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
KIA-9531		Charred hazelnut shell	Pit 611, context 679. Associated with decorated Bowl pottery akin to assemblage from Abingdon causewayed enclosure (Pine and Ford 2003)	4697±35	−27.5			3640–3360	*3630–3575* (*19%*) or *3535–3480* (*23%*) or *3475–3370* (*53%*)
North Stoke									
BM-1405		Red deer. Antler crown fragment	Bank barrow, W ditch, section 1, ditch floor. Beneath rapidly accumulated primary fill in narrow gravel-cut ditch (Case 1982b, 62–8, 74, figs 34–6, pl. 2B)	4672±49	−22.9			3640–3350	*3630–3575* (*12%*) or *3535–3355* (*83%*)
Dorchester-on-Thames									
OxA-119		Human. Sample taken from collection comprising L calcaneum and astragalus, 4 tooth crowns, 3 molars, 1 canine, half a thoracic vertebral arch, a rib fragment, part of L radius, 2 metapodials and a phalanx (Harman 1992)	F3003. Pit 1.5 m x 1 m with black loam fill containing charcoal, ash and a flint scraper, cut by NW side of D-plan enclosure in turn succeeded by S end of cursus (Whittle *et al.* 1992, 153, 195–7, fig. 9)	4800±130				3940–3340	*3585–3020*
BM-2443		Red deer. Antler	Site VIII. Primary fill of SW cursus ditch, in area of long enclosure cut by N end of cursus (Whittle *et al.* 1992, 160, 195–7, figs 4, 5)	4510±100	−24.1			3520–2900	*3635–3555* (*12%*) or *3535–3140* (*83%*)
BM-2440	33	Red deer. Collagen from antler tines	Site XI. Bottom of Ditch I. Innermost ditch of small multi-circuit henge set in break in SW cursus ditch (Whittle *et al.* 1992, 164–5; Bradley and Chambers 1988, 279)	4320±90	−21.8			3330–2670	
BM-2442	87	Red deer. Collagen from brow tine of antler	From a similar context to the sample for BM-2440	4320±50	−21.4			3090–2870	
BM-4225N		Red deer. Antler pick	Site 2. Upper surface of primary fill of penannular ring ditch set in NE angle of D-plan enclosure at SE terminal of cursus (Whittle *et al.* 1992, 153–7)	4230±50	−21.1			2920–2670	
Mount Farm, Berinsfield									
OxA-15748	MF602	Human	Grave F602. Fragment of L femur from articulated primary burial of male at centre of oval ring ditch F602 (*c.* 12 m x 10 m), accompanied by flint knife and blades	4738±35	−20.9	11.5	4730±33 T'=8.1; T'(5%)=3.8; ν=1	3640–3370	*3640–3495* (*71%*) or *3440–3375* (*24%*)
HAR-4673	MF602i	Human	From the same skeleton as OxA-15748	4460±90	−22.9				

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
South Stoke									
NZA-18465	<5010>	Charred hazelnut shell	Pit 5019. One of a cluster of 7 pits. Contained plain and decorated Bowl pottery, struck flint, ?quern fragment, charcoal, charred plant remains, animal bone (Timby *et al.* 2005, 228–39, 261–8)	4708±40	−24.2			3640–3360	*3630–3590* (*7%*) or *3535–3490* (*17%*) or *3470–3370* (*71%*)
NZA-18466	<5009>	Charred hazelnut shell	From the same context as NZA-18465	4752±40	−25.0			3640–3370	*3630–3555* (*10%*) or *3545–3495* (*18%*) or *3460–3375* (*67%*)
NZA-18463	<5000>	Charred hazelnut shell	Pit 5025. One of a cluster of 7 pits. Contained plain and decorated Bowl pottery, struck flint, charcoal, charred plant remains, animal bone (Timby *et al.* 2005, 228–39, 261–8)	4726±45	−24.3			3640–3370	*3630–3580* (*8%*) or *3540–3490* (*17%*) or *3470–3370* (*70%*)
NZA-18502	<5012>	Charred hazelnut shell	From the same context as NZA-18463	4668±40	−25.0			3630–3360	*3625–3600* (*5%*) or *3525–3370* (*90%*)
NZA-18464	<5004>	Charred hazelnut shell	Pit 5027. One of a cluster of 7 pits. Contained plain and decorated Bowl pottery, struck flint, charcoal, charred plant remains, animal bone (Timby *et al.* 2005, 228–39, 261–8)	4673±40	−24.5			3630–3360	*3625–3600* (*5%*) or *3525–3480* (*17%*) or *3475–3370* (*73%*)
NZA-18462	<5011>	Charred hazelnut shell	Pit 5031. One of a cluster of 7 pits. Contained undiagnostic crumbs of pottery, struck flint, charred plant remains (Timby *et al.* 2005, 228–39, 261–8)	4718±40	−26.2			3640–3370	*3630–3585* (*7%*) or *3535–3490* (*17%*) or *3470–3370* (*71%*)
NZA-18501	<5005>	Charred hazelnut shell	From the same context as NZA-18462	4701±40	−25.2			3460–3360	*3625–3595* (*6%*) or *3535–3485* (*17%*) or *3470–3370* (*72%*)
NZA-18467	<5001>	Charred hazelnut shell	From the same context as NZA-18462	4710±40	−25.2			3640–3360	*3630–3590* (*7%*) or *3535–3490* (*17%*) or *3470–3370* (*71%*)

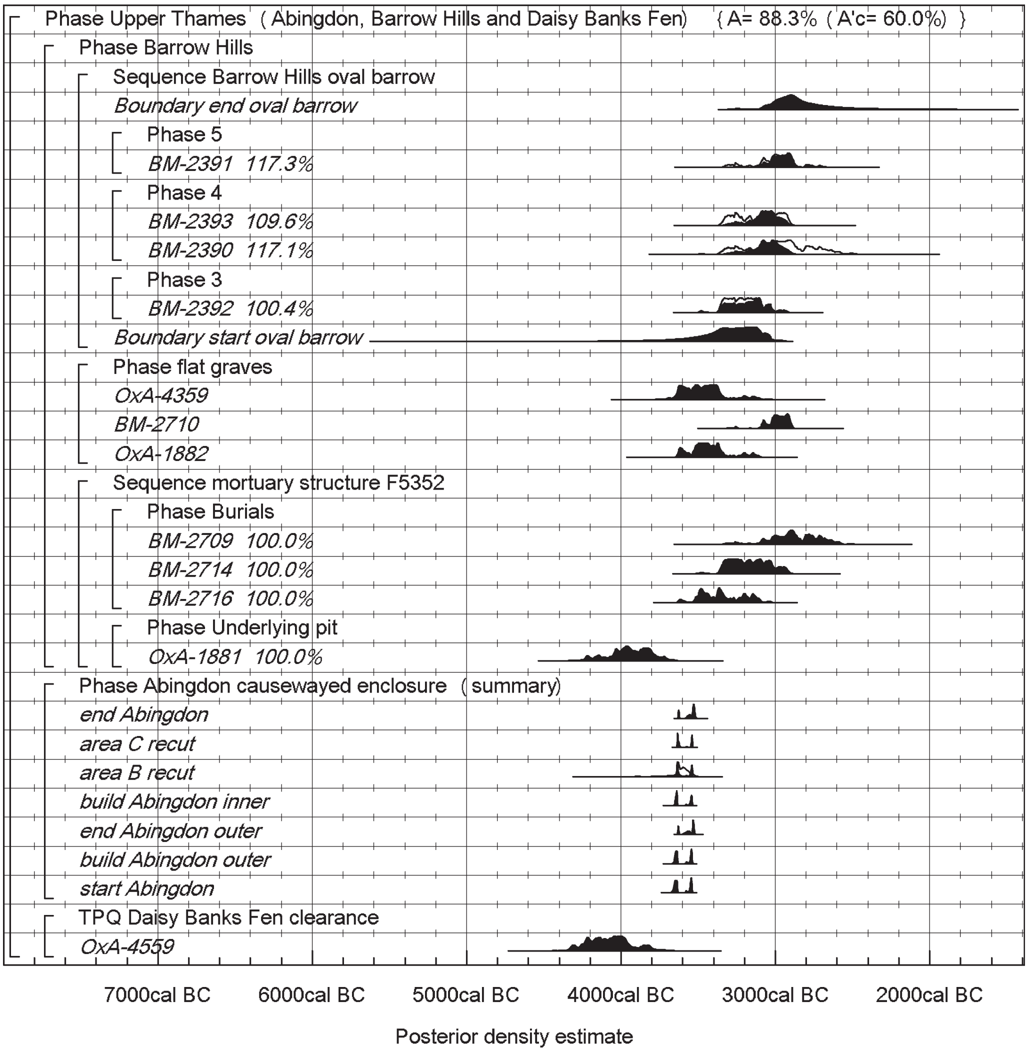


Fig. 8.29. Abingdon, Barrow Hills and Daisy Banks. Probability distributions of dates from the causewayed enclosure, derived from the model shown in Figs 8.18–21, from Neolithic activity at Barrow Hills, and for the clearance episode in the Daisy Banks pollen core. The format is identical to that of Fig. 8.3. The model for Barrow Hills is defined exactly by the brackets down the left-hand side of the diagram.

the oval barrow on this site falls in the last third of the fourth millennium cal BC (Fig. 8.29); it derives, however, from its third structural phase, the first two phases remaining undated (R. Bradley 1992; Barclay and Halpin 1999, 18–28). It is worth noting a second oval cropmark some 350 m north-west of the causewayed enclosure, mooted as a possible long barrow by O.G.S. Crawford (Fig. 8.13; Barclay and Halpin 1999, 1–2, fig. 1.2), as well as a long barrow with flanking ditches 3 km to the south-west (Pugh 1998).

Another, less conspicuous, aspect of funerary practice may be represented by a female skeleton apparently associated with an Abingdon Ware Bowl, an antler pick and a small amount of animal bone, recovered during the construction of a tennis court at Pangbourne, just south of the Goring Gap, in 1928 (Piggott 1929).

Understanding the chronological relationship of causewayed enclosures and cursus monuments is fundamental to an appreciation of society in the fourth millennium cal BC. The Drayton cursus, lying only 5 km south-west of Abingdon and on the same bank of the Thames, is one of the better dated examples in Britain, being built in *3640–3520 cal BC* (*92% probability*; Fig. 8.30: *build Drayton cursus*) or *3445–3405 cal BC* (*3% probability*), probably in *3610–3550 cal BC* (*68% probability*) (Barclay and Bayliss 1999; Barclay *et al*. 2003, 180–7). Unfortunately, the bimodal distributions of the posterior density estimates for the construction and use of the Abingdon enclosure leave the question of its dating relative to the Drayton cursus open. If Abingdon was built and used on the first peak of its probability distributions in the third quarter of the 37th century cal BC, the Drayton cursus is later, possibly by only a generation or two. If, however, Abingdon was constructed and used on its second peak in the third quarter of the 36th century cal BC, then there is a sporting chance (*63% probable*) that Drayton is earlier, if only by a generation or two. Whatever the case, it is probable that there were people who could have witnessed the

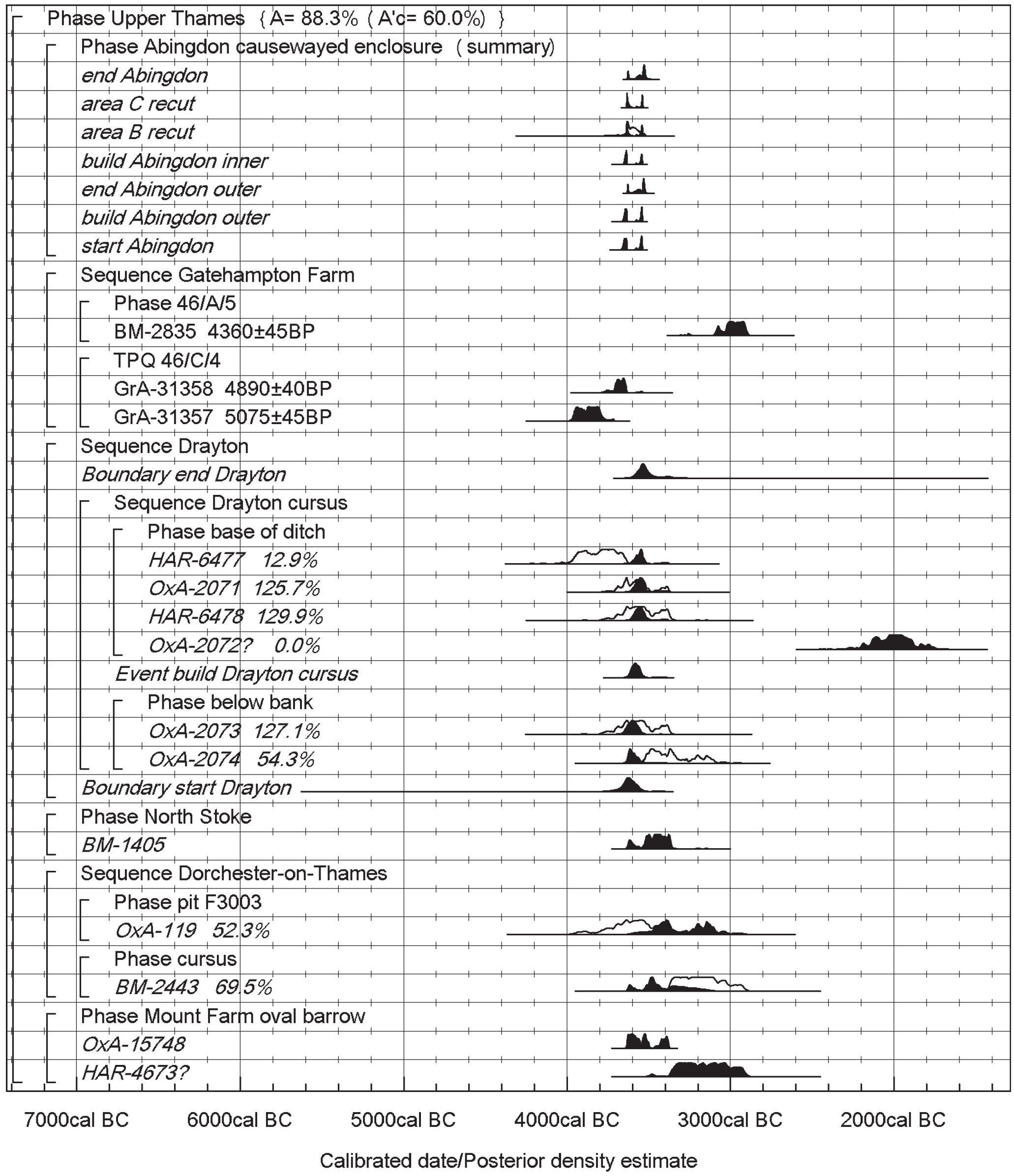


Fig. 8.30. The Upper Thames valley. Probability distributions of dates from the enclosures at Abingdon and Gatehampton Farm, derived from the models shown in Figs 8.18–21 and 8.12, from features related to long monuments at Drayton, North Stoke and Dorchester-on-Thames, and from an oval barrow at Mount Farm. The format is identical to that of Fig. 8.3. The model for Mount Farm and the long monuments is defined exactly by the brackets down the left-hand side of the diagram.

construction of both the causewayed enclosure and the cursus within their lifetimes.

Dates on antler picks from the primary fill of the Dorchester-on-Thames cursus and the base of the North Stoke bank barrow ditch demonstrate that these monuments were constructed after the Abingdon enclosure had been abandoned (Fig. 8.30: *BM-2443, -1405*). The Dorchester-on-Thames cursus cut through two long enclosures which are undated, one of them in turn cutting a pit which is broadly contemporary with the Abingdon enclosure (Fig. 8.30: *OxA-119*). Recent AMS dating of the central burial in the Mount Farm oval barrow suggests that it may also be broadly contemporary with the Abingdon enclosure, since it dates to 3640–3375 cal BC (95% confidence; Fig. 8.30: OxA-15748). A previous measurement (Fig. 8.30: HAR-4673) made on the same skeleton in 1982 is significantly more recent, probably because of the incomplete removal of contaminants from this sample (as the $\delta^{13}C$ is slightly enriched). Comparable burials at Linch Hill Corner, Stanton Harcourt (Grimes 1960, 154–64), and Newnham Murren, Wallingford (Moorey 1982), may be of similar date.

The Gatehampton Farm and Abingdon enclosures could be contemporary, although the dating of the former is extremely tenuous. They and possibly some 'mortuary' enclosures, like those cut by the Dorchester-on-Thames cursus, may be the earliest monuments in the Upper Thames catchment apart from some Cotswold long barrows (see Chapter 9), and date to the mid-fourth millennium cal BC. Earlier settlement evidence is present, however, as demonstrated by the rectangular building at Yarnton.

8.7 The wider region

Was life along the great river different from that in other regions of southern England? In central and western Europe, the earliest Neolithic settlement is closely linked to the river valleys. Few LBK settlements are far from valleys, water and good soils (Whittle 1996; Gronenborn 1999; Lüning 2000); the likely connection is with the needs of cultivation, seen now in one influential model as a garden system (Bogaard 2004; 2005; G. Jones 2005; Bogaard and Jones 2007). This pattern extends into northern France, as shown by intensive research in the Aisne and other valleys in the Paris basin (Ilett and Hachem 2001; Demoule *et al*. 2007). The lowest parts of the largest rivers themselves, such as Danube, Rhine and Seine, often seem from regional studies of the LBK and its fifth millennium cal BC regional successors to have been less frequented than higher terraces, or their tributary systems in general. We also know, in one or two instances, of valley-based late Mesolithic communities, from the examples of Noyen-sur-Seine in the Paris basin (Mordant and Mordant 1992), and Hardinxveld and other sand islands in the Rhine-Maas delta of the Netherlands (Louwe Kooijmans 2001a; 2001b; 2007). It is hard to think of all these situations without a central role and place for the river valleys. Indigenous people had inhabited at least some of them; river valleys seem to have been a major conduit for the spread of the Neolithic way of life and its early practices; and at least one major delta – that of the Rhine and Maas – was the setting for what looks like a long, slow transformation of the way of life of indigenous people alongside their Neolithic neighbours.

From the perspective of the near continent, the current state of evidence from the Thames is at first glance rather unexpected. The river does not, on our current understanding, stand out as the prime locus for established southern indigenous communities in the fifth millennium cal BC. A Mesolithic presence can certainly be shown, in both upper and middle Thames (Hey and Barclay 2007), but is not particularly well documented in either. From the recent work at Heathrow we have gained a small pit cluster on the junction of terrace and Colne valley, TL-dated probably to the seventh millennium BC (M. Allen and Gardiner 2002; Lewis and Welsh 2004; Framework Archaeology 2006, 31–3). Although no large late Mesolithic sites have been found at the Eton Rowing Course, later Mesolithic activity is widespread there. Tree-throw holes containing assemblages of struck flint of this date have been found in several parts of the site. Most have been identified by the presence of microliths, but one assemblage overlies a waterlogged deposit in the base of a tree-throw hole dated to 5220–4940 cal BC (95% confidence; 6130±45 BP; OxA-9412; Tim Allen, pers. comm.). Much of the area of London itself may have been marsh (Wilkinson and Sidell 2007). Moving up the river, there is a significant quantity of later Mesolithic material from Gatehampton Farm (A. Brown 1995). Few traces of Mesolithic presence, however, were found in the extensive investigations of the floodplain at Yarnton in the upper Thames; one has to go to the middle Kennet for better evidence (Froom 1972a; 1972b).

Nor does the middle and upper Thames valley stand out as a particularly early locus for Neolithic settlement in southern England. The dating evidence presented above shows that occupation including substantial structures and middens can be put as far back as perhaps the 38th or 39th century cal BC at Yarnton (Fig. 8.27), and the 38th century cal BC at the Eton Rowing Course (Fig. 8.8). In the current state of the evidence this presence is no earlier than, and perhaps indeed a little later than, that documented under the Ascott-under-Wychwood long barrow and the Hazleton long cairn in the Cotswolds (Bayliss *et al*. 2007c, fig. 3; Meadows *et al*. 2007, fig. 6), which go back in the case of the former certainly to the 39th and perhaps to the 40th centuries cal BC (Chapter 9). Similar date ranges can be suggested for the earliest human remains at Coldrum in the Medway valley and for the substantial structure at White Horse Stone nearby, while a burial at Yabsley Street, Blackwall, may date to the first quarter of the fourth, if not to the end of the fifth, millennium cal BC (Chapter 7). The implications of this state of affairs in the Thames Valley, where a lot of developer-funded investigation has been concentrated in recent years (Hey and Barclay 2007), are followed in Chapters 14 and 15.

We have only – and imperfectly – dated four enclosures out of 14 certain and probable examples in the upper and middle Thames valley. We cannot show that any is earlier than the 37th century cal BC; but none of them need in fact be that early. The earliest circuit at Staines is perhaps more likely to have been constructed in the latter 36th or 35th centuries cal BC (Fig. 8.3). Eton Wick likewise probably falls in the later part of the currency of causewayed enclosures, perhaps in *3520–3455 cal BC* (*68% probability*; Fig. 8.5: *build Eton Wick inner*). Gatehampton Farm was constructed sometime in the fourth millennium cal BC: on the basis of the *terminus post quem* provided by GrA-31538 (Fig. 8.12; Table 8.3), in or after the 37th century cal BC. The date of the Abingdon enclosure, as set out above, is unclear; it was built either in the third quarter of the 37th or the third quarter of the 36th century cal BC (Fig. 8.22).

Nor can we point to other forms of construction or public architecture in the middle and upper Thames as being significantly earlier than the enclosures, apart from the rectangular structure at Yarnton. There are relatively few candidates for long cairns or barrows in the Thames valley itself: monuments that have elsewhere – on the Wessex Chalk and in the Cotswolds – been shown to date from the 38th century cal BC onwards (Bayliss and Whittle 2007; but see Burn Ground, Chapter 9, which might be earlier still). Known examples, in addition to that at Abingdon, are at Drayton, Drayton St Leonard and Benson, all close to cursus monuments (Barclay *et al*. 2003, 225–32, pl. 2.1, figs 2.1, 10.2, 10.5).

There are long 'mortuary' enclosures, including those at Dorchester-on-Thames (Whittle *et al*. 1992), but there is no evidence at present to suggest their precise date in the Thames valley sequence. Neolithic activity earlier than the enclosures so far dated is represented by pits and the range of features seen at Yarnton. With all this in mind,

we might even claim from the evidence as it currently stands that initial development of the Neolithic in both the middle and upper Thames was rather late, an issue we also discuss in Chapter 14. Certainly it need not be seen as markedly different from elsewhere, and the known middens and structures suggest the same flux of places, tethered mobilities and routines of tenure and movement as can be envisaged for many other parts of southern Britain.

The question then arises of whether this profile remained static from the 37th century cal BC onwards. There were now, in contrast to earlier centuries, a series of differences which can suggest the emergence of a more distinctive character for the valley, to which this dating programme has contributed. Judging by the four enclosures under consideration, these locales were used as actively for gathering, exchange and deposition as elsewhere, though given the extent of excavations – with the obvious exception of Staines – this is hard to quantify. The style of enclosure, while far from being uniform, looks increasingly distinctive in the Thames valley. Circuits are recurrently, though not universally, multiple and are often incomplete, in that streams or the river itself are drawn into the formation of their boundaries (Oswald *et al.* 2001, fig. 6.4). Even the more complete circuits, as at Staines, are either in fact based partly on watercourses or placed with close reference to them. Perhaps then, at some kind of general level, the flow of water – a dominant fact of valley life – was central to the thinking of enclosure builders, and this could have served to mark out valley users from other people (see also D. Field 2004a, 158–9). The inner circuit at Abingdon saw more than one episode of construction, in that initial pits were subsequently enlarged. Staines, by contrast, may appear as more of a unitary layout. The dating of Abingdon suggests both rapid construction and brief use. If we can extend this as a working model for the chronology of the enclosures of the upper Thames as a whole, we have perhaps a way to explain their considerable numbers; these were event-like and episodic constructions, rapidly built and rapidly abandoned. In the Thames valley, as far as we can tell so far, only Abingdon became a locale where history and people lingered, with the long funerary and monumental history of Barrow Hills, immediately outside the enclosure (Barclay and Halpin 1999). Can the lack of such developments at other such sites help to define the nature of existence in the Thames valley from the 37th or 36th centuries cal BC onwards?

Two further features appear relevant here. Certainly as far as the upper Thames is concerned, we perhaps need to look beyond the valley itself, from the 37th century cal BC onwards. Surely the striking concentration of long cairns and barrows in the Cotswolds – flourishing there by that date (Whittle *et al*. 2007a) – and the relatively fewer enclosures in the Cotswolds themselves (Chapter 9) have to be connected to the prominent concentration of enclosures in the Thames valley. Different domains of existence may have been played out in different parts of the landscape, from the flows of life and intense sociality in the valley to the perhaps more remote resting places of the dead in the adjacent uplands. That is a matter for future research in the upper Thames at least, to see whether it can be established that there was a direct connection between the two landscape zones, as has begun to be shown through isotopic analysis for early Neolithic communities and their animals in the Rhine and upper Danube catchments (Price *et al*. 2001; Bentley 2007). The difference – or in converse, the connection – might be less sustainable for the middle Thames, though the role of the Chilterns and the Berkshire Downs could benefit from further investigation. And, further downstream, is there anything to be made of the frequency of flint and stone axeheads, including continental jadeitites, from the lower reaches of the river itself (Adkins and Jackson 1978; R. Bradley 1990, 67; J. Lewis 2000, 74), contrasting with the apparent absence of monuments? Was the lower end of the valley perceived as another significantly different zone (cf. D. Field 2004a), calling for depositions and offerings rather than monument construction?

Secondly, we might take the cumulative evidence for settlement and the existence of smaller, quite closely spaced, other constructions such as at New Wintles Farm in the upper Thames and the first phases of Staines Road Farm and Horton in the middle Thames, to suggest rather numerous communities up and down the Thames valley by the middle part of the fourth millennium cal BC. The detail of this claim has been set out elsewhere (A. Barclay *et al*. 1996; A. Barclay 2007; Hey and Barclay 2007; Hey *et al*. 2007). If it stands, could this be the context from which to understand both the character of existence in the Thames valley and its differences compared to elsewhere in southern Britain? Was there an inverse relationship between the relative density of settlement in the valley and the suggested brevity (with resulting high numbers) of its enclosures? We have to be careful of circular argument here, since there are other enclosures shown by this project to be of short duration which might not so obviously belong to such populous landscapes, but did the relative density of population in the Thames valley prevent any one locale in it from becoming pre-eminent? Or did the linear nature of valley existence lend itself to sets of spatially ordered social relationships?

In the Thames valley, as elsewhere in southern Britain, it appears that most cursus monuments and bank barrows succeed causewayed enclosures. The Thames valley evidence is as imperfect as elsewhere, but it is probable that linear constructions such as those of North Stoke and Dorchester-on-Thames followed the enclosures in the second half of the fourth millennium (Fig. 8.30). Drayton is the exception, being rather earlier and probably dating to before 3500 cal BC (Fig. 8.30). We do not know its chronological relationship with the nearby Abingdon enclosure, but both monuments were probably built within a single human lifespan. If there is a succession from circularity to linearity, Abingdon and Drayton sit at its transition. Cursus monuments are a feature of the middle Thames too, and up and down the valley as a whole, whatever their dates and relationships, they can

be seen as spaced at intervals along the valley, markedly so in parts of the upper Thames (J. Thomas 1999, fig. 8.1; A. Barclay *et al*. 2003; cf. Benson and Miles 1974). This could be seen as a reinforcement and to some extent a sealing of patterns established in the preceding centuries, Drayton speculatively succeeding Abingdon, for example, and Stanwell succeeding Staines, with other smaller constructions such as the two Radley oval barrows (Barclay and Halpin 1999, fig. 1.4) fitting into these framed landscapes.

The connection of both enclosures and cursus monuments with water is notable, and may be a further general argument for continuity of some kind, but the relationships change. Cursus monuments provide direction and linkage, and also perhaps subtle visibilities (Framework Archaeology 2006, 52–81), in a way perhaps that causewayed enclosures did not. Some of the Thames valley cursus monuments, including Dorchester-on-Thames, appear to track or mimic the course of the river in question (cf. C. Richards 1996; A. Barclay *et al.* 2003; Barclay and Hey 1999), but others run across watercourses. Drayton does both, running parallel to a palaeochannel of the Thames and across a small tributary (A. Barclay *et al.* 2003, 95–6).

The role of small henge-like monuments in this development is unclear. They are frequent in the upper Thames catchment and the south-east Midlands, often in the same monument complexes as cursus monuments and other elongated enclosures (Loveday 1989, 71–7; A. Barclay *et al.* 2003, 223). Few are dated, and one of them, ring ditch 611 at Barrow Hills, Radley, was not built until after the start of the third millennium cal BC on the evidence of dates on two antler implements from near the base (Table 8.6: BM-2712–3; Barclay and Halpin 1999, 35–44). At Dorchester-on-Thames, where the numerous such monuments clustered around and within the cursus have been extensively investigated (Atkinson *et al.* 1951; Whittle *et al.* 1992), none were in stratigraphic relationship with it and some seem to have post-dated it. The innermost and perhaps the earliest of the three ditches of Site XI, built close against one side of a gap in the south-west ditch of the cursus, contained antler picks dated to the late fourth or early third millennium cal BC (Table 8.6: BM-2440, -2442). Another antler pick from the surface of the primary silt of site 2, a penannular ring ditch within the south-east end of the cursus, is dated to the early third millennium cal BC (Table 8.6: BM-4225N). Artefactual evidence for an early or mid-fourth millennium date for sites I and II (Whittle *et al.* 1992, table 11) is tenuous because it consists of small quantities of material which could been redeposited in an area of repeated prehistoric activity. In this area the limited available evidence suggests that these monuments were built after the cursus monuments.

We have been considering a model of continuity and development, in which valley causewayed enclosures are generally succeeded by cursus monuments. We need to point out, however, that there may be yet further complications in the record, apart from the difficulties of dating. Quite large areas have by now been uncovered in some parts of both middle and upper Thames. Substantial structures remain few and far between, and as elsewhere, like also middens, may prove to be a feature of a relatively early stage of Neolithic presence. Judging by the contents of an extensive number of pits which have been subject to careful excavation and flotation, there may have been reduced levels of cultivation in the middle or latter part of the fourth millennium cal BC (Hey *et al*. 2003; Hey and Barclay 2007). This possibility, and the number of causewayed enclosures and cursus monuments still waiting to be excavated and dated up and down the valley, show how much remains to be done before we really begin to understand Neolithic life in the Thames valley.

Notes

1 Since this chapter was drafted, a further measurement on unidentified charcoal (3520–3350 cal BC (95% confidence); 4640±30BP; KIA-38666) has been obtained from one of a number of earlier Neolithic pits at Cippenham, Berkshire (Ford and Taylor 2004, 99–102), providing a *terminus post quem* for the deposition of early Neolithic pottery and lithics including a leaf-shaped arrowhead from the feature (Steve Ford, pers. comm).

2 Each of these samples has acceptable individual convergence (C=99.3%, C=99.6%, and C=98.5% respectively).

9 The Cotswolds

Philip Dixon, Alex Bayliss, Frances Healy, Alasdair Whittle and Timothy Darvill

The limestone hills of the Cotswolds form the south-western part of the Jurassic ridge which extends from the Bristol Channel north-eastwards into Lincolnshire and Yorkshire. To their south-east, tributaries of the upper Thames rise on the gentle dip slope; to their north-west, the scarp rises abruptly above the Severn valley and the Vale of Evesham (Fig. 9.1). The densely distributed and numerous long barrows of the area include long recognised and investigated examples (Darvill 2004a), but causewayed enclosures were recognised in the area only comparatively recently. That on Crickley Hill was discovered during the excavation of the Iron Age hillfort there in 1971 (Dixon 1988a), and that on

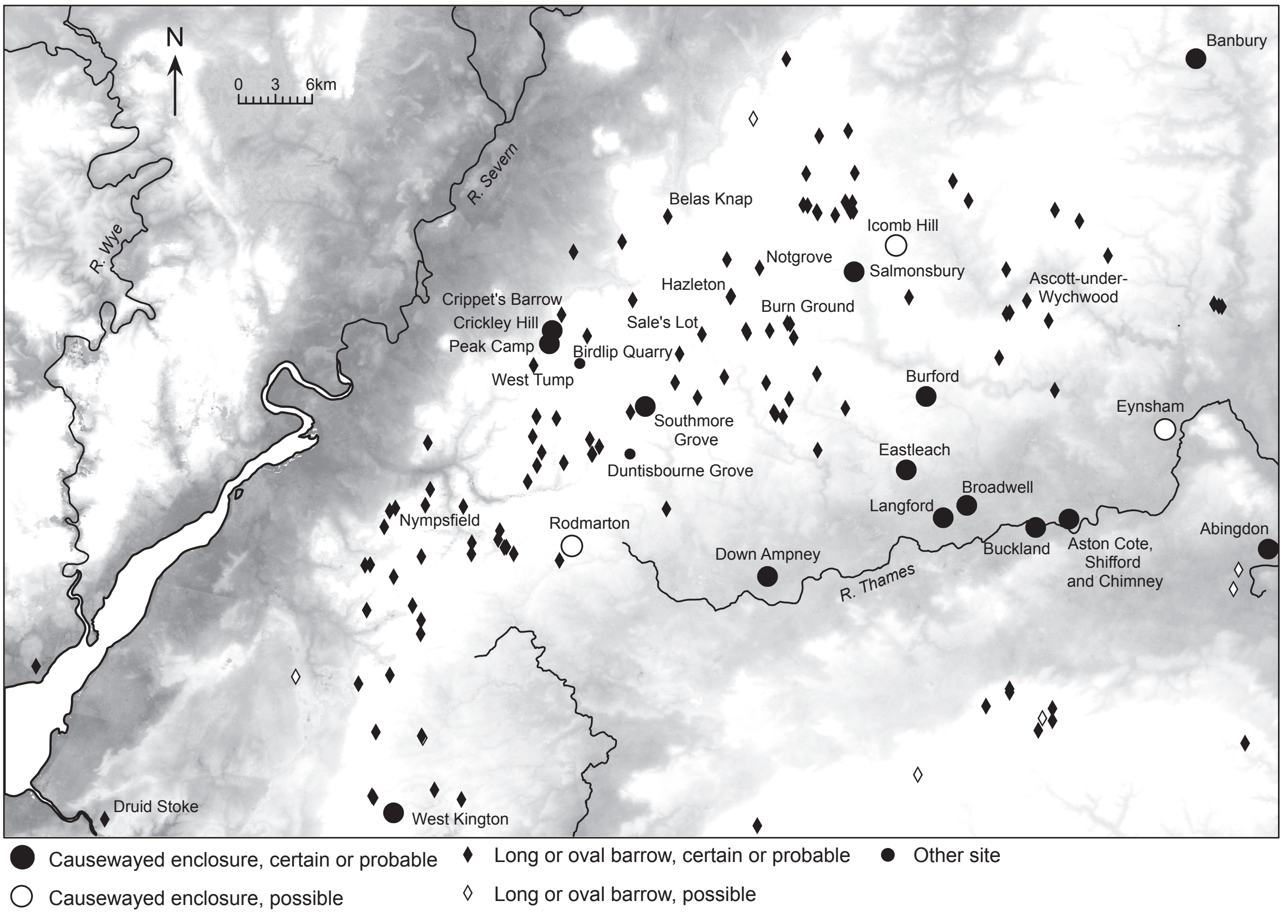


Fig. 9.1. The Cotswolds and the adjoining part of the Upper Thames catchment, showing causewayed enclosures, long barrows and other sites mentioned in Chapter 9.

Peak Camp by excavation in 1980–1 (Darvill 1981; 1982a). There are five other probable causewayed enclosures in the region: at West Kington, at the extreme southern limits of the Cotswolds in north Wiltshire; Southmore Grove some 10 km south-east of Crickley Hill and Peak Camp; Salmonsbury some 20 km to the east; farther off at Burford in Oxfordshire and, farther east again, at Banbury. A possible example, Icomb Hill, is some 5 km north-east of Salmonsbury, and a less convincing length of elongated pits or ditch segments at Rodmarton lies to the south (Oswald *et al*. 2001, fig. 1.1). The distribution merges into that of the upper Thames catchment (Chapter 8; Oswald *et al.* 2001, fig. 6.4). Eastleach, for example, in the Leach valley, a tributary of the upper Thames, lies only some 10 km from Burford (Oswald *et al*. 2001, fig. 4.20). These enclosures were recognised mainly between 1983 and 1994, though Icomb Hill had been suspected since 1964 on air photographic evidence (Oswald *et al*. 2001, 152, 154, 157). This history suggests that more will probably be revealed, particularly by aerial survey.

Almost all the known and probable sites are in elevated positions. Crickley Hill and Peak Camp lie on the edge of the scarp, the others on varying parts of the dip slope. West Kington and Southmore Grove are on south-facing slopes above streams (Oswald *et al.* 2001, figs 5.20, 5.23, 7.2), Burford on a hilltop above a stream and Icomb Hill on a south-east-facing slope above another. An exception may be formed by an arc of two undated causewayed ditches within an Iron Age fort at Salmonsbury (A. Marshall 1995; Oswald *et al*. 2001, fig. 4.12), which recent geophysical survey has confirmed as likely to form part of a causewayed enclosure, corresponding to sections of interrupted ditch encountered by Dunning during his excavation of the hillfort (Dunning 1976; Darvill 2006, 23, fig. 5). This site lies on river gravels in the confluence of two watercourses, a location more usual farther to the south-east (Chapter 8). The enclosures coincide in general with the notable concentration of long barrows in the Cotswolds. Both Crickley Hill and Peak Camp have long barrows as near neighbours, as do West Kington, Southmore Grove, Icomb Hill, Salmonsbury and Rodmarton (Darvill 2004a, fig. 78). This is an important regional concentration, especially if we do not make too rigid a distinction between the eastern Cotswolds and the upper Thames catchment, though it has figured little so far in discussions of possible regional groupings among causewayed enclosures (R. Palmer 1976a; Oswald *et al.* 2001, 110–11, figs 6.1, 6.4). Open-area excavation has been confined to Crickley Hill, and smaller-scale excavation to Peak Camp and Salmonsbury. Saville's investigations at Icomb Hill (1978) have demonstrated a Neolithic presence, but not the existence of an enclosure. A pit close to the Banbury cropmark contained sherds from at least three plain Bowls, one of them light-rimmed and carinated (Cuenca 2006). Since the pit was identified in the course of a watching brief on the route of a pipeline it is impossible to tell whether or not it was isolated.

9.1 Crickley Hill, Coberley, Cotswold, and Badgeworth, Tewkesbury, Gloucestershire, SO 92650 16100

Location and topography

Crickley Hill lies on the edge of the Cotswold scarp (Fig. 9.1). It is a steep-sided triangular promontory rising to 265 m OD, defined by narrow valleys to the north-east and south-west and overlooking the broad plain of the river Severn to the north-west. The highest part of the promontory is a central knoll, bounded to the south-west by a narrow natural gully in the hilltop, known as the long mound valley. The underlying rock is Lower Inferior Oolite. Below the Oolite are much softer Lias clays and silts, the erosion of which has led to the collapse of the limestone at the edges of the hill, with consequent landslips, and to the deformation of the limestone which remains *in situ* on top of the hill (Firman 1994). There is clear evidence from the preservation of prehistoric finds even in the topsoil that the hill has never been ploughed, and that the only loss has been through slow natural erosion of the upper surfaces, with the result that archaeological preservation is everywhere better than at most excavated causewayed enclosures. The gully of the long mound valley is a zone of accumulation in which preservation is exceptional, and shallow, ephemeral features survive in an intercalated sequence of archaeological deposits and natural silts.

One kilometre to the south-west is a further causewayed enclosure, Peak Camp (see below), separated from Crickley only by a narrow valley (Darvill 1981; 1982a; 1986). Long barrows or cairns lie on other promontories along the scarp, including Crippets Barrow on the spur immediately north-east of Crickley Hill and West Tump on the next spur but one to the south-west of Peak Camp (Fig. 9.1; Darvill 1982a, 6; 1984a, fig. 3).

History of investigation

The clearly visible Iron Age hillfort on Crickley Hill was one of the foci of a project conceived in 1968 by Richard Savage, the aim of which was to elucidate the function and relationships of the many hillforts on the Cotswold scarp by investigating two neighbouring hillforts (Crickley and Leckhampton) and an adjacent lowland settlement (Sandy Lane in Cheltenham). In the event, the excavations of Philip Dixon on Crickley Hill far outlasted the initial project, taking place annually from 1969 to 1995. In the first two seasons, attention was focussed on the periphery of the hillfort, especially the entrance area. In 1971, however, investigation of a smaller, less conspicuous circuit around the central knoll of the hill revealed a sequence of Neolithic enclosures, occupying about 3 ha, some 60% of which was investigated over the following years (Dixon 1994). Landslips and recent quarrying make it difficult to determine if any of the circuits was originally complete.

The Neolithic sequence which emerged from excavation has been outlined by Dixon (1988a) and parts of it have been elaborated in several theses and dissertations, notably

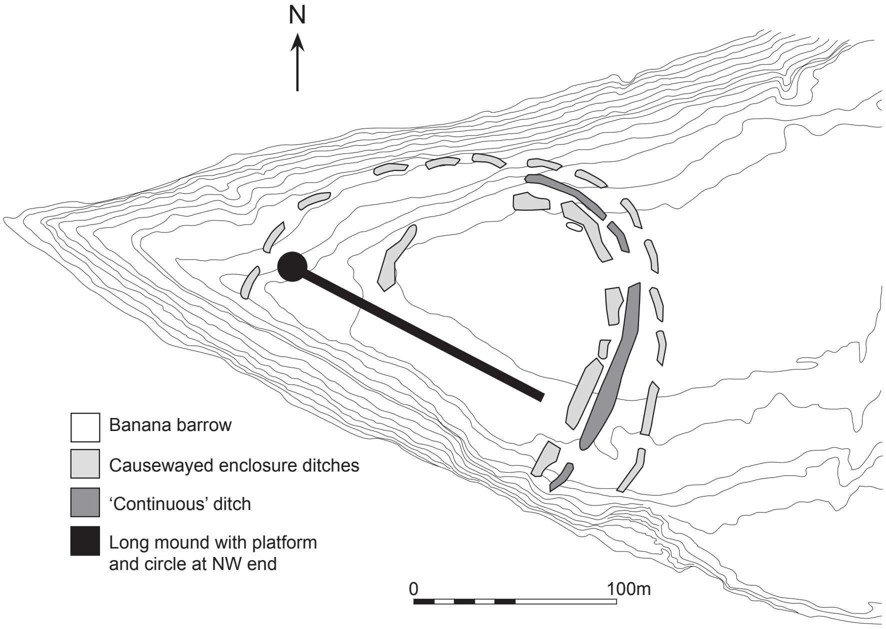


Fig. 9.2. Crickley Hill. Plan showing inner and outer causewayed enclosure ditches, continuous ditch and long mound. After Dixon (2005).

Fig. 9.3. Crickley Hill. The banana barrow. Photo: Philip Dixon.

by Snashall (1997; 1998) and Hollos (1999). This is summarised in Table 9.1 (with details of the site phasing). The remarkable extent of that sequence and the diversity of its structures make the site unusual among enclosures of the period in Britain (Fig. 9.2).

The earliest features (site phase 1a) are all stratified below the banks of the Neolithic enclosures. To the north of the site, on a low raised summit, a series of small pits surrounded an area measuring approximately 3 m by 8 m (Fig. 9.3). This was overlain by the bank of the inner of

Table 9.1. The Crickley Hill Neolithic sequence as it appeared in 2004, after Dixon (1988a), Snashall (1997; 1998) and Hollos (1999).

Phase	**Outer causewayed ditch**	**Inner causewayed ditch**	**Continuous ditch**	**Long mound valley**	**Remainder of interior**
1a	Stake-built structures beneath bank in W, microliths nearby Probable treehole F674 beneath bank in E	'Banana barrow' beneath bank in NE			Pits? Post-built structures?
1b(i)	Single causewayed circuit backed by low stone bank with wooden palisade. Possibly contemporary with construction of inner causewayed ditch. At least 3 entrances, each with wooden gate. Banks thrown back into ditch segments			1st road	Pits? Post-built structures?
1b(ii)	Recut, banks rebuilt 2 entrances blocked, remaining E entrance aligned on that in inner ditch	Inner causewayed enclosure, larger earthwork than outer with at least 3 gates, also backed by low stone bank with wooden palisade		2nd road and fences	Pits? Post-built structures?
1c(i)	Recut	Recut			Pits? Post-built structures?
1c(ii)	Fence set in silted ditch	Recut			Pits? Post-built structures?
1c(iii)		Fence set in silted ditch			Pits? Post-built structures?
1d		Covered by bank of continuous ditch	Construction of almost continuous ditch with 3 definite entrances, cellular bank	More fencelines along road Pits? Rectangular and trapezoid post-built structures? Platform and shrine	Pits? Post-built structures? Platforms? Intercutting pits aligned on road?
			Slot with burning	Addition(s) to side of platform	
1e(i)				Cairn built overlapping SE side of platform and shrine	
1e(iii)-a				Long mound a built over cairn	
1e(ii)-a				Stone circle built over platform and shrine, cutting end of cairn and ?long mound a	

Phase	Outer causewayed ditch	Inner causewayed ditch	Continuous ditch	Long mound valley	Remainder of interior
1e(ii)-b				2nd floor on circle	
1e(iii)-b				1992 cairn built at tail of long mound a	
				Long mound b built on to tail of long mound a over 1992 cairn. Relation of this event to 1e(ii) unknowable, although both post-date 1e(i)	
1e(iii)-c				'Cairnlets' built at tail of long mound b Post- and stake-built structures? Three postholes across SE end of valley	
			SE entrance covered by long mound c	Long mound c built over 'cairnlets', 3 postholes, structures	

two concentric causewayed circuits, enclosing some 2 ha. Ephemeral circular stake-built structures also pre-date the outer ring of causewayed ditches. This causewayed enclosure (site phases 1b–c), each circuit with an internal bank, contained at least four entrances, and was protected by fences on the low stone banks. The outer causewayed circuit was seen as earlier than the inner because one of its entrances was realigned before being linked to a corresponding entrance in the inner circuit by a roadway and fence (Dixon 1988a, 78; site phase 1b(i) followed by site phase 1b(ii)).

The two causewayed circuits were succeeded by a single, more continuous, circuit of ditches (site phase 1d) (Figs 9.4–5). This second enclosure was entered by at least three gateways, and was protected by a solid fence at the rear of the stone platform which constituted its broad bank. This enclosure was the subject of an attack, in the course of which hundreds of arrows tipped with leaf arrowheads landed in the area of two entrances, and the palisade was burnt down. Numerous interior features may relate to any phase of the use of the hill. The apparently Neolithic ones include pits and platforms.

The sequence in the long mound valley is complex. A succession of fenced tracks along the valley led from one of the entrances of the continuous enclosure to a stone platform (attributed to site phase 1d), interpreted as the site of a shrine. Rectangular post-built structures aligned along the tracks in the long mound valley have been taken to be contemporary with them (Dixon 1988a, 82: periods 1c(i) and 1d). Other features were built over the phase 1d platform; in phase 1e a stone cairn lapped its edge and was covered by the first, north-west, section of a long mound of turf and soil. This was subsequently truncated by the construction of a stone circle which went through two phases. The mound was twice extended to the south-east (Table 9.1; Dixon 1988a). In 1988, the view was that 'the end of the ritual phase 1e is still uncertain … It occurred before the building of the hillfort' (Dixon 1988a, 86), this phase of use being 'a lengthy period which may have continued well into the Bronze Age' (Dixon 1988a, 87).

Previous dating

At the start of the dating project the stratigraphic sequence was well established (Table 9.1), but its chronology remained to be elucidated, there being no radiocarbon dates for the Neolithic phases. The assemblage of flint and pottery fell into the period conventionally described as early Neolithic, with comparanda at Windmill Hill.

Objectives of the dating programme

Many questions presented themselves. What was the date of the earliest, pre-enclosure, structures on the hill? Were the inner and outer causewayed circuits built at the same time or successively? What was the interval between the two causewayed circuits and the continuous circuit? For how long was each enclosure in use? Was it possible

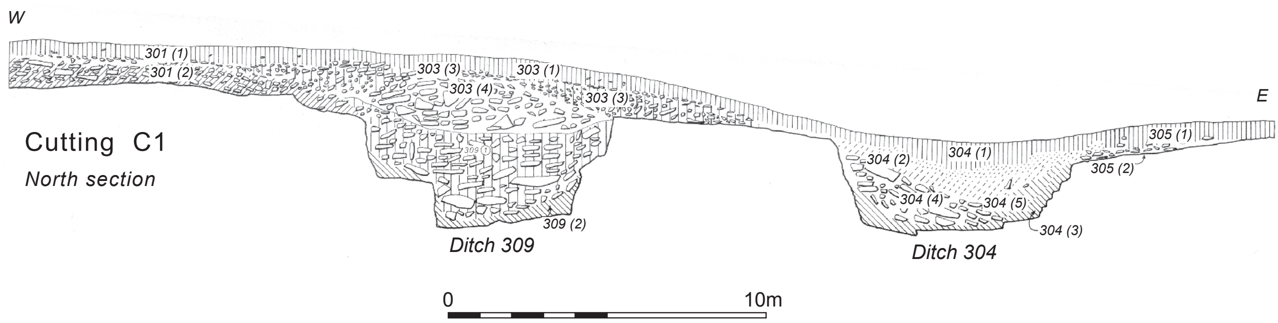


Fig. 9.4. Crickley Hill. Cutting C1. Section showing inner causewayed enclosure ditch (309) and the surviving remnant of its bank (301(2)) overlain by the bank (303) of the continuous ditch (304). After Dixon (1971).

Fig. 9.5. Crickley Hill. Cutting CI, looking south. The inner causewayed ditch (foreground) and the continuous ditch (background). Photo: Philip Dixon.

to provide a date for the spectacular conflict relating to the continuous ditch and perhaps the interior? Could the chronology of the complex sequence in the long mound valley, especially the structures at the north-west end of the long mound, be elucidated? Could the post-built structures be shown by radiocarbon dating to be Neolithic? Finally, what was the relationship between Crickley Hill and Peak Camp, approximately 1 km to the south-west? This is particularly pertinent because the topographical relationship and the spacing of the two strongly recall those of the main enclosure and the Stepleton enclosure on Hambledon Hill in Dorset, which were considered to be parts of a single complex enclosed by Neolithic outworks (see Chapter 4).

Sampling strategy and simulation

The potential for producing a refined chronology for the Neolithic enclosures at Crickley Hill appeared to be considerable and unusual, because of the relative dating provided by the stratigraphic relationships between the various earthworks. To exploit this, the principal tactic of the sampling strategy was to obtain sequences of samples through successive enclosures, ideally at different locations. This was achieved with less than complete success, because the enclosure ditches were less rich in finds than anticipated, and because analysis of the finds assemblages was not yet complete at the time of sampling.

Once potential samples had been identified, simulations were run to determine how many of them needed to be dated (Fig. 9.6). For this site, simulation proved to be less helpful than was generally the case in this project. Because the absolute date of the Neolithic archaeology on the hill was unknown at the beginning of our analysis, a minimum number of samples from each earthwork had to be dated to provide the outline chronology required for a more sophisticated sampling strategy to be developed. In fact, the vertical stratigraphy at Crickley Hill has been

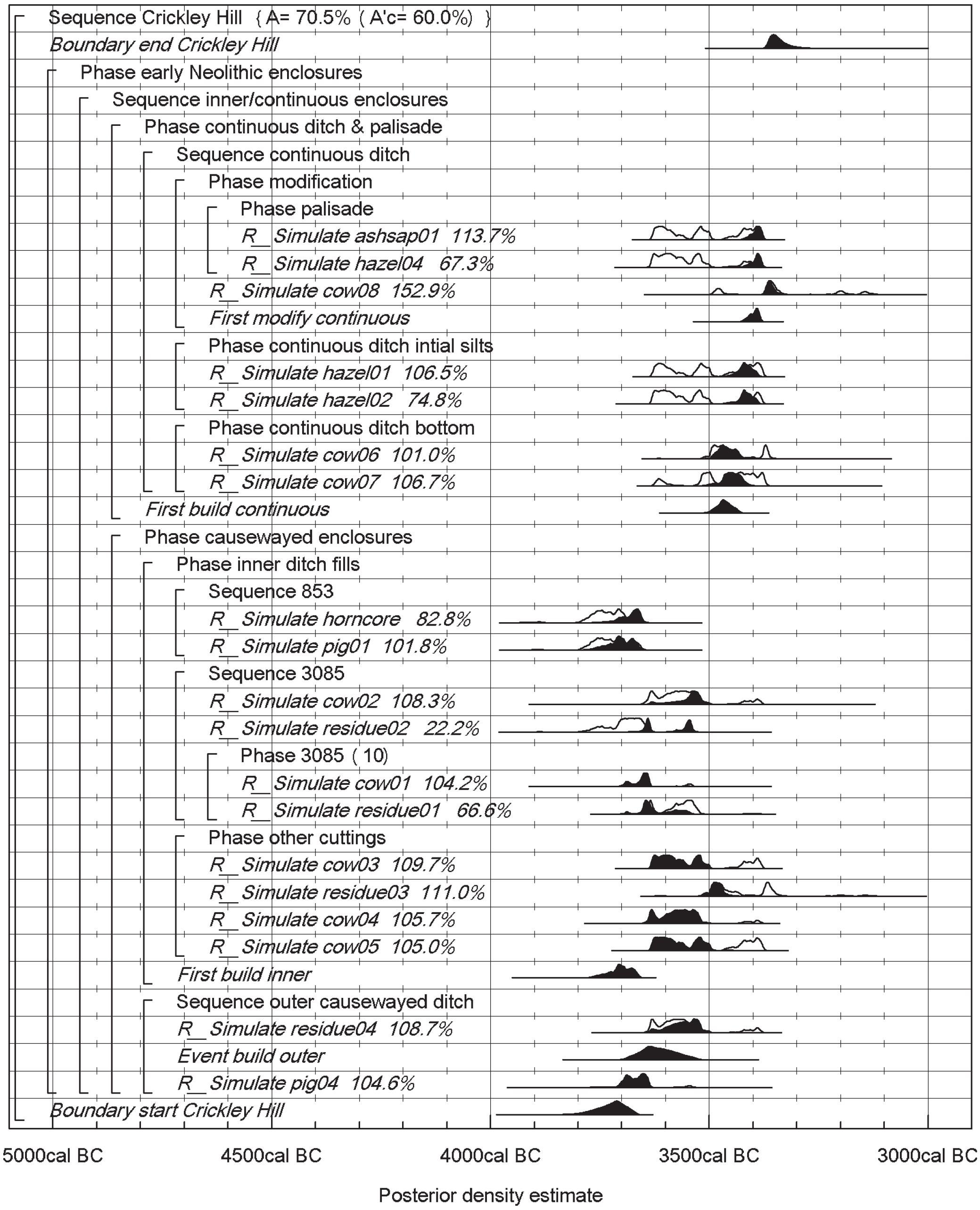


Fig. 9.6. Crickley Hill. Probability distributions of simulated dates. Each distribution represents the relative probability that an event occurred at a particular time. For each of the dates two distributions have been plotted, one in outline which is the result produced by the scientific evidence alone, and a solid one which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution 'start Crickley Hill' is the estimated date when Neolithic activity at Crickley Hill started. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

so informative that few samples were required beyond the first, basic framework.

Results and calibration

A total of 48 radiocarbon determinations were obtained for prehistoric activity on Crickley Hill as part of this project. All but four of these samples date to the fifth and fourth millennia cal BC. Full details of all the radiocarbon measurements are given in Table 9.2.

Analysis and interpretation

Our preferred model for the chronology of Neolithic activity on Crickley Hill is shown in Figs 9.7–11. The overall structure of the model is shown in Fig. 9.7. Figures 9.9–10 show the components of this model relating to the Neolithic enclosures. This is constructed on the premise that the use of the Neolithic enclosure circuits forms a basically uninterrupted and continuous phase of activity. The model also incorporates the interpretation that the outer circuit of the causewayed enclosure was built before

Table 9.2. Radiocarbon dates from Crickley Hill, Gloucestershire. Posterior density estimates derive from the models defined in Figs 9.7–10 and 9.11.

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate* (*cal BC*) (*95% probability*)
Inner causewayed ditch								
GrA-27815	CH75 1945/B	One of 40 unidentifiable bone fragments	CV. F2046(2). From the lower layer of one of a group of short lengths of ditch surrounding an ovoid area (known as the banana barrow). Beneath 2005/3, the remnant of the bank of the inner causewayed enclosure which in turn underlay the bank of the continuous enclosure	5215±40	−23.5		4230–3950	*4155–4130* (*2%*) or *4075–3955* (*93%*)
OxA-14315	CH75 1945/A	One of 40 unidentifiable bone fragments	From the same context as GrA-27815	5178±32	−22.8		4050–3950	*4045–3955*
GrA-27814	CH75 1347	Unidentifiable bone fragment	CV. F2035. From one of a group of short lengths of ditch surrounding an ovoid area (known as the banana barrow)	5270±40	−23.2		4240–3970	*4225–4205* (*2%*) or *4170–3970* (*93%*)
OxA-14314	CH75 2490	Unidentifiable bone fragment	CV. F2039(2). From the lower layer of one of a group of short lengths of ditch surrounding an ovoid area (known as the banana barrow)	7288±36	−20.8		6240–6050	*6225–6065*
GrA-27818	CH75 2920	Cattle, proximal radius and ulna fragments, probably articulating	CV. F2033(2). Found with other animal bone in primary silt overlying ditch bottom	4770±40	−22.1		3650–3370	*3640–3560*
GrA-27820	CH77 4721/B	Cattle. R metacarpal articulating with 2 associated carpals. Replicate of OxA-14414	L99. F2615(3). A post-primary fill of segment F2615 of inner causewayed ditch, possibly the fill of a recut in turn cut by definite recut, in turn overlain by bank of continuous ditch (2601)	4770±40	−21.9	4728±26 T'=1.9; T'(5%)=3.8; ν=1	3640–3370	*3600–3530*
OxA-14414	CH77 4721/A	Cattle. R metacarpal articulating with 2 associated carpals. Replicate of GrA-27820	From the same context as GrA-27820	4696±35	−21.0			
OxA-14413	CH78 4053	Cattle, articulating L metacarpal and magnum	N5. F3077. From a recut in inner causewayed ditch segment 3085, cutting layer 2 of that segment and overlain by layer 1, which was in turn overlain by the bank of the continuous ditch	4786±32	−20.5		3650–3510	*3595–3535*
GrA-31100	CH78 4421	Cattle. Distal humerus fragment probably from larger animal than metatarsal fragment CH78 4432, in good condition	O6. F3085(10). Bottom layer of segment F3085 of the inner causewayed ditch, below 3085(9)	4710±40	−21.6		3640–3360	*3635–3565*
OxA-15575	CH78 4432	Cattle. Distal metatarsal fragment probably from smaller animal than humerus fragment CH78 4421, in good condition	From the same context as GrA-31100	4698±35	−21.2		3640–3360	*3635–3565*
OxA-14354	CH78 4433, 4437	Neolithic Bowl body sherds with internal residue, joining along recent break to form large sherd approx. 70 mm x 50 mm, in fresh condition	From the same context as GrA-31100	4746±33	−29.6		3640–3370	*3635–3560*
GrA-27816	CH78 4275	2 recently broken fragments of a Neolithic Bowl sherd with internal residue under limey crust. External spalling suggests that it has been burnt. Sherd and ancient breaks under limey crust are fresh and unabraded	O6. F3085(5). An upper layer of inner causewayed ditch segment F3085, overlying layers 4, 7 and 10. All the fills of F3085 were overlain by the bank of the continuous ditch	4885±45	−28.7		3770–3540	*3770–3630*

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-27828	CH78 4544	Neolithic Bowl sherd with internal residue under limey encrustation	O6. F3138(4). Layer of primary silt in bottom of segment F3138 of inner causewayed ditch	4850±40	−28.4		3710–3530	*3660–3615* (*49%*) or *3610–3545* (*46%*)
GrA-31101	CH78 4549	Cattle. Substantial distal femur fragment in good condition. Probably from larger animal than tibia CH78 4551	From the same context as GrA-27828	4705±40	−22.0		3640–3360	*3635–3565*
OxA-15574	CH75 323	Shed roe deer antler, complete and in good condition	CIVa: F853(4). In thin skin of primary silt at bottom of ditch, equivalent to 853(3) in 1972	4725±34	−22.3		3640–3370	*3635–3565*
OxA-14415	CH72 4856	Pig. Metapodial fragment fitting unfused epiphysis	CIV. F853(3). 'grey soil mass' equivalent to 853(4) in CIVa	4900±32	−20.7		3750–3630	*3760–3740* (*4%*) or *3735–3725* (*1%*) or *3715–3635* (*90%*)
GrA-27821	CH72 4856, 4980	CIV. Pig. Two joining fragments of proximal end of pig femur (CH72 4856) fitting unfused epiphysis (CH72 4980)	From the same context as OxA-14415	4815±40	−21.7		3660–3520	*3695–3675* (*3%*) or *3665–3555* (*92%*)
Outer causewayed ditch								
GrA-27813	CH72 4227	Pig. First and second phalanges, articulating. Note on certificate: 'GrA-27813 was a bad target'	CIV. F674(1). Found with other scraps of bone in in probable treehole 240 cm wide and 18 cm deep overlain by F611(3a), the base of the bank of the outer causewayed ditch	4830±170	−21.8	4636±39 T'=1.4; T'(5%)= 3.8; ν=1	3520–3350	
GrA-30368	CH72 4227	Replicate of GrA-27813	From the same context as GrA-27813	4625±40	−21.7			
OxA-14386	CH80 4674	Four small shell-tempered Neolithic Bowl body sherds, possibly from the same pot, with internal residue. They are from a different pot to CH80 4652 because their temper is considerably denser than its	M8. F4299(3). In the layer immediately above the primary silt (layer 4) in segment F4299 of the outer causewayed ditch	4736±30	−27.2		3640–3370	*3635–3555*
OxA-15704	CH80 4652/B	Residue from one of >40 shell-tempered Neolithic Bowl sherds, most of them from 1 pot, some fresh and well preserved, many with internal residue. They are not from the same pot as CH80 4674, the sample for OxA-14386, because their temper is considerably less dense than its. Replicate of GrA-31103. Certificate: 'OxA-15704 was a very small sample, 0.319 mgs C was produced in the combustion of 2.4 mgs of pretreated carbon from the sherd.'	M8. F4295=F4299(2). Second layer of outer ditch, overlying F4929(3)	4530±45	−29.4	4490±32 T′=1.6; T′(5%)= 3.8; ν=1	3360–3020	*3350–3085* (*94%*) or *3045–3030* (*1%*)
GrA-31103	CH80 4652/A	Replicate of OxA-15704	From the same context as OxA-15704	4450±45	−24.4			
Continuous ditch								
OxA-14416	CH72 4807	Pig. Proximal end of L femur, fitting unfused epiphysis. Replicate of OxA-14417	CIV. F602(3). Topmost layer of the inner causewayed ditch, beneath the bank of the continuous ditch	4890±32	−20.3	4857±23 T'=2.2;	3700–3635	*3700–3635*

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate* (*cal BC*) (*95% probability*)
OxA-14417	CH72 4807	Replicate of OxA-14416	From the same context as OxA-14416	4823±32	−20.4	T' (5%)=3.8; ν=1		
UB-6395	CH74 3396	Cattle. Articulating L ulna and radius, cut-marks near proximal ends of both	K1. F1802, base. Found together at base of ditch butt at N side of entrance	4803±22	−22.4±0.5		3645–3525	*3570–3525*
UB-6397	CH77 4582	Cattle, centra of 4 lumbar vertebrae, 4 thoracic vertebrae, 2–3 indeterminate vertebrae. Also numerous vertebra fragments and some rib fragments. The size of the centra is such that they could all have come from the same vertebral column	N7. F2659, bedrock, at a depth of 1.60 m. On base of continuous ditch. The fact that at least 8 adjacent vertebrae were found together indicates that they were buried when still articulated, although their preservation is such that it is not possible to verify this	4769±22	−22.6±0.5		3640–3515	*3575–3520*
GrA-27911	CH72 F603(6) un-numbered A	1 fragment *Corylus avellana*. From same find as samples for OxA-14321, OxA-14428	CIV. F603(6). Primary silt of continuous ditch. The quantity of charcoal, and the presence among it of substantial fragments indicate that it was freshly deposited	4780±40	−26.4		3650–3380	*3555–3510*
OxA-14428	CH72 F603(6) un-numbered B	1 fragment *Corylus avellana*. Replicate of OxA-14321	From the same context as GrA-27911	4913±34	−25.9	4901±23 T'=0.2; T'=(5%)= 3.8; ν=1	3710–3640	*3710–3640*
OxA-14321	CH72 F603(6) un-numbered B	1 fragment *Corylus avellana*. Replicate of OxA-14428	From the same context as GrA-27911	4891±31	−25.9			
UB-6396	CH77 4517	Cattle. Complete R tibia, exceptionally well preserved	N5. F2688, bedrock, at a depth of 88 cm–1.1 m. From a recut in F2659 which extended down to a step in the limestone, overlain by layers 2659(3) and 2359(4). Stratified above CH77 4582	4681±20	−22.4±0.5		3625–3370	*3525–3480* (*70%*) or *3475–3425* (*25%*)
UB-6394	CH71 F370 un-numbered	Cattle. Articulating R tibia, astragalus and calcaneum from 2–3 year-old individual	CII. F370. From section across tail of bank of continuous ditch	4619±27	−22.2±0.5		3500–3350	*3510–3445*
GrA-31106	CH77 2657/B	Single fragment *Corylus* sp.	N4. F2657(2). Palisade trench F2657. One of several charcoal finds from palisade trench in surface of bank of continuous ditch. The trench survived as a band of burnt stone, where the palisade had burnt down	4710±40	−24.7		3640–3360	*3540–3425*
GrA-31105	CH77 2657/A	Single fragment *Corylus* sp.	From the same context as GrA-31106	4675±40	−24.4		3630–3360	*3530–3430*
OxA-14322	CH77 F2657 'C14 sample' B	*Fraxinus excelsior* sapwood. From same find as sample for GrA-27914	N5. F2657. One of several charcoal finds from palisade trench in surface of bank of continuous ditch	4567±33	−24.8		3490–3110	*3500–3455*

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-27914	CH77 F2657 'C14 sample' A	*Fraxinus excelsior* sapwood. From same charcoal find as sample for OxA-14322	From the same context as OxA-14322	4660±40	−24.3		3630–3350	*3525–3435*
Long mound valley sequence								
GrA-31111	CH85 150/B	Single fragment of *Corylus* sp.	W96. F6379. From a horizontal area of tightly-packed rubble paving the SE part of limestone platform underlying cairn built beneath NW end of long mound and in turn underlying stone circle and its successive floors (Snashall 1997). The large size and good preservation of the charcoal, by the standards of the site, indicate that the wood was freshly charred when buried	5465±45	−27.5		4370–4230	*4445–4415* (*3%*) or *4400–4380* (*1%*) or *4375–4230* (*91%*)
GrA-31110	CH85 150/A	Single fragment of *Corylus* sp.	From the same context as GrA-31111	5435±40	−27.9		4360–4230	*4355–4230* (*94%*) or *4195–4175* (*1%*)
GrA-31114	CH85 189/B	Single fragment of *Corylus* sp.	From the same context as GrA-31111	5480±40	−27.8		4440–4250	*4450–4415* (*6%*) or *4400–4380* (*2%*) or *4375–4250* (*87%*)
GrA-31113	CH85 189/A	Single fragment of *Corylus* sp.	From the same context as GrA-31111	5420±40	−27.4		4350–4170	*4355–4225* (*91%*) or *4200–4165* (*4%*)
GrA-27809	CH84 sample 730/A	Charred hazelnut shell fragment	X96. F5674. From surface of cobbling forming second floor of small stone circle cutting NW end of long mound. Overlay first floor of circle. The sample is one of 64 fragments of charred hazelnut shell recorded from 21 findspots in this context. A local concentration of charred plant remains (as well as of charcoal and burnt bone fragments) suggests that the burnt material derived from the use of the circle	4630±40	−24.4		3520–3340	*3525–3340*
OxA-14311	CH84 sample 730/B	Charred hazelnut shell fragment	From the same context as GrA-27809	4707±35	−24.3		3640–3370	*3635–3555* (*24%*) or *3540–3485* (*21%*) or *3470–3370* (*50%*)

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-14312	CH78 2901	Cattle. Unfused femur head	Q6. F2835. Posthole of structure 1 (slightly trapezoid, approx. 6 m x 3.4–4.7 m, formed of postholes F2798, F2802, F2806, F2811, F2826, F2833, F2835). Beside and parallel to a stake-lined track leading from an entrance in the continuous enclosure to the platform and shrine. Both the track and at least some postholes of the structure underlay a palaeosol overlain by the third and final extension of the long mound (long mound c). The symmetry of the plan suggests that all the postholes belonged to the same structure and were contemporary (Snashall 1998, 16–20, figs 13–18). Sherds from two other postholes of the structure appear to be of second or even first millennium BC date	4702±30	−22.3		3630–3370	*3630–3580* (*18%*) or *3535–3485* (*21%*) or *3470–3370* (*56%*)
GrA-27806	CH78 2901, 3454	Cattle. First, second and third phalanges, articulating	From the same context as OxA-14312	4750±45	−22.8		3650–3370	*3640–3495* (*73%*) or *3455–3375* (*22%*)
OxA-14313	CH77 4889	Pig. Mandible fragments and 4 teeth, extracted from larger find of fragmented bones	Q6. F2806. Posthole of structure 1. Sherds from F2806 include 2 fragments of grog- and ?flint-tempered protruding base angle which appear to be of second or even first millennium BC date (CH77 4660). There are also heavily gritted fragments including a base angle and body sherd with incised chevron	2344±27	−21.2		410–380	*515–430* (*26%*) or *425–375* (*69%*)
GrA-27810	CH78 2766B	Cattle-sized animal. Long bone fragment	P6. F2830. One of row of 3 postholes across SE end of long mound valley. Beyond end of second extension of long mound, covered by third extension (Hollos 1999, 137–9). Another posthole in the row (F2825) contained a small fragment of simple, grog-tempered post-Neolithic flat rim (CH78 3293)	4735±45	−21.8		3640–3370	*3640–3495* (*64%*) or *3460–3375* (*31%*)
GrA-27808	CH78 2250	Pig. L mandible, 2 joining fragments (recently broken)	Q6. F2701/6. Under stone slab 2717 in body of third and final extension of the long mound (Hollos 1999, 39–40, 327, 343)	2265±35	−22.3		400–200	*390–350* (*13%*) or *320–200* (*82%*)
OxA-14497	CH78 423	Cattle. R astragalus	P6. F2740(3). Placed under stone slab 2792 in body of third and final extension of the long mound, at its SE end, where the mound was delimited by cobbling (Hollos 1999, 39–40, 327, 343). Side-by-side with proximal fragment of second phalanx, and fragments, some joining, of unidentified long bone, all eroded. Breaks appear to have occurred when bone already old	4480±33	−22.4		3350–3020	*3345–3085* (*89%*) or *3065–3025* (*6%*)

Laboratory Number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
OxA-14418	CH77 2079	Weathered end of red deer antler pick. Beam, base, brow tine present; bez tine seems never to have grown	P6. F2734(1). On track through E entrance in continuous ditch, between bank terminals. Overlain by wash 2702(2)	2978±37	−21.3		1380–1050	*1375–1340 (3%)* or *1320–1110 (89%)* or *1105–1070 (3%)*

the inner, on the basis of the spatial and organisational argument outlined above. There is no assumption of continuity from the stratigraphically pre-enclosure features or from the fifth millennium cal BC constructions revealed by the radiocarbon dating programme (Figs 9.8 and 9.11). Similarly, no continuity is assumed between the series of enclosures and the less well dated sequence of constructions in the long mound valley (Fig. 9.11).

The banana barrow. Sealed under the bank of the inner circuit, a series of small pits demarcated a central area measuring approximately 8 m by 3 m. Because of the layout of these features, they were immediately known on site as the 'banana barrow' (Fig. 9.3). The infill of the pits was reasonably homogenous, very hard-packed and virtually without finds; some stones had been reddened by fire. The stratigraphy in most of the pits was horizontal and it was conjectured that they had been deliberately filled rather than silted. The central area between the pits consisted of a low mound about 0.15 m high, containing the bases of four or five postholes, but it is by no means clear whether these belong to this feature or to the overlying enclosure bank. The sole finds from the pits were a few flint flakes and over 150 largely unidentifiable bone fragments, all of them small and most of them heavily weathered. The identified pieces are, from layer 1 of F2046, a cattle molar fragment of a size appropriate for domestic cow, two long bone fragments so thick-walled as to possibly be of aurochs, as well as other, thinner-walled ones; and, from layer 1 of F2036, a fragment possibly from a pig tibia and a cattle-sized rib fragment (Jacqui Mulville and Adrienne Powell, pers. comm.). Four bone fragments have been dated (Table 9.2: GrA-27814–5, OxA-14314–5). One (OxA-14314) is of seventh millennium cal BC date and must be redeposited in this context, as the other three samples produced statistically consistent radiocarbon measurements (Table 9.2: T'=3.2; T'(5%)=6.0; ν=2). These measurements suggest that the animals who yielded these samples died in *4640–3970 cal BC* (*95% probability*; Fig. 9.8: *build banana barrow*), probably in *4185–3990 cal BC cal BC* (*68% probability*).

It is clear from the poor condition of the bones that they are unlikely to have been placed immediately in the contexts in which they were discovered. The question of residuality is therefore important, but it is reasonable to assume that the pits had been filled from the central mound and so these bones could have formed part of the mound before its razing. The fact that they are statistically consistent could accord with their having formed part of its construction. However, it remains possible that the bones derived from some earlier context disturbed by the building of the banana barrow. How much earlier the banana barrow was than the inner causewayed enclosure circuit cannot, therefore, be securely estimated, but the density of the layering within the ditches suggested to the excavators a longer period of concretion than had occurred in the subsequent Neolithic ditches.

The outer causewayed ditch. This formed a probably complete circuit containing at least 15 separate segments,

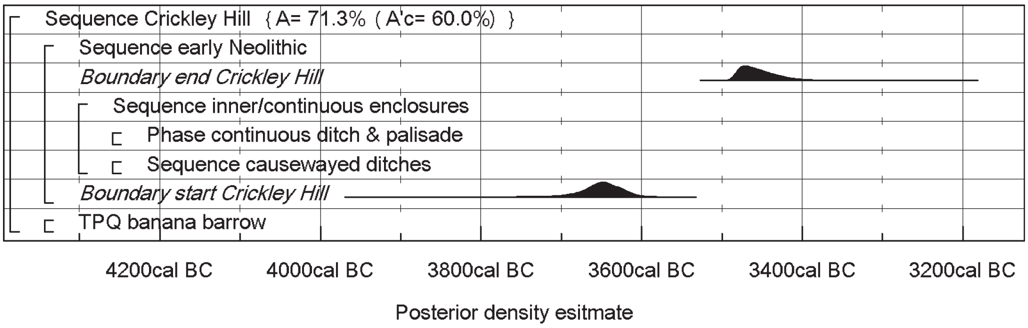


Fig. 9.7. Crickley Hill. Overall structure of the chronological model for the Neolithic enclosure sequence. The component sections of this model are shown in detail in Figs 9.8–10. The large square brackets down the left-hand side of Figs 9.7–10, along with the OxCal keywords, define the overall model exactly.

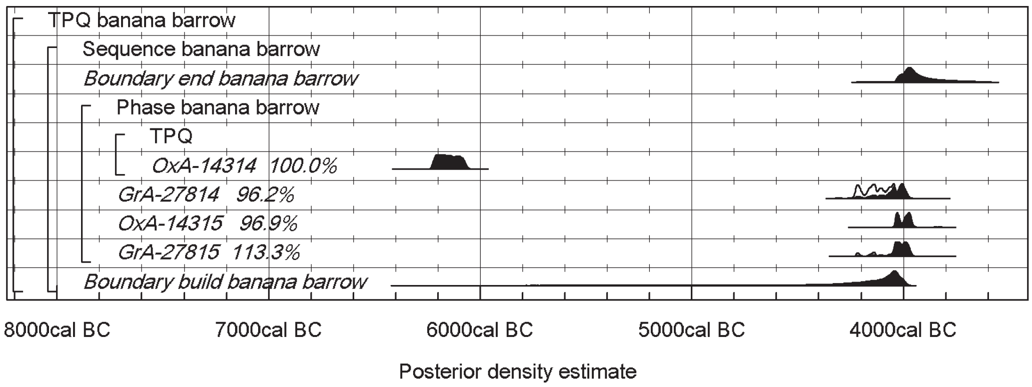


Fig. 9.8. Crickley Hill. Probability distributions of dates obtained from the banana barrow. Each distribution represents the relative probability that an event occurred at a particular time. For each of the dates two distributions have been plotted, one in outline which is the result produced by the scientific evidence alone, and a solid one which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution 'build banana barrow' is the estimated date for the construction of the feature. Dates followed by a question mark have been calibrated (Stuiver and Reimer 1993), but not included in the chronological model for reasons explained in the text. The overall structure of this model is shown in Fig. 9.7, and its other components in Figs 9.9–10.

of a variety of sizes, but mostly around 1.5 m wide and 1 m deep (Fig. 9.2). On the inner side lay the banks, small and low, which contained at least five entrances, each broadly corresponding to an entrance in the inner causewayed ditch. Because of this spatial relationship between the two circuits, the stratigraphic relationship between the banana barrow and the inner circuit has been extended to include the outer circuit.

The estimate for the date of the outer ditch is based on an inadequate tally of samples, since there was very little cultural material in any of the excavated segments. As already noted, the model incorporates the interpretation that the outer circuit was built before the inner, on the spatial and organisational argument outlined above. Two articulating pig phalanges (Fig. 9.9: CH72 4227) were recovered from a probable tree-throw hole (described as a 'disturbed depression') partially sealed by the bank of the outer circuit. Residue from one of four sherds probably from the same pot in the rubble fill of the ditch in another cutting (Fig. 9.9: *OxA-14386*) was also dated. Despite the stratigraphy of these contexts, the pig phalanges are markedly younger than the residue. It seems on the whole more likely that the small pig phalanges were incorporated in the treehole after the building of the bank. The fact that four sherds from the same vessel were present in the rubble fill suggests that the pot in question was fairly freshly broken when they were buried and, given its position above the primary fills, the residue dated should provide a *terminus ante quem* for construction. A third sample from the soil fills overlying this sherd was provided by residue from one of more than 40 sherds from another pot (Fig. 9.9: *CH80 4652*). This date provides a *terminus ante quem* for a late stage in the silting of the ditch and is not necessarily earlier than the construction of the continuous ditch which elsewhere seals the rubble fill of the outer causewayed circuit.

This model (Figs 9.7 and 9.9) suggests that the outer causewayed circuit was built in or shortly before *3685–3595 cal BC* (*95% probability*; Fig. 9.9: *taq outer*), probably in or shortly before *3660–3615 cal BC* (*68% probability*).

The inner causewayed ditch. This consists of a series of limestone-cut segments, on average over 2 m wide and at least 1 m deep; their length was variable (Fig. 9.2). Their shape suggested that the longer segments had begun as a series of small round pits, since their bases were seldom flat,

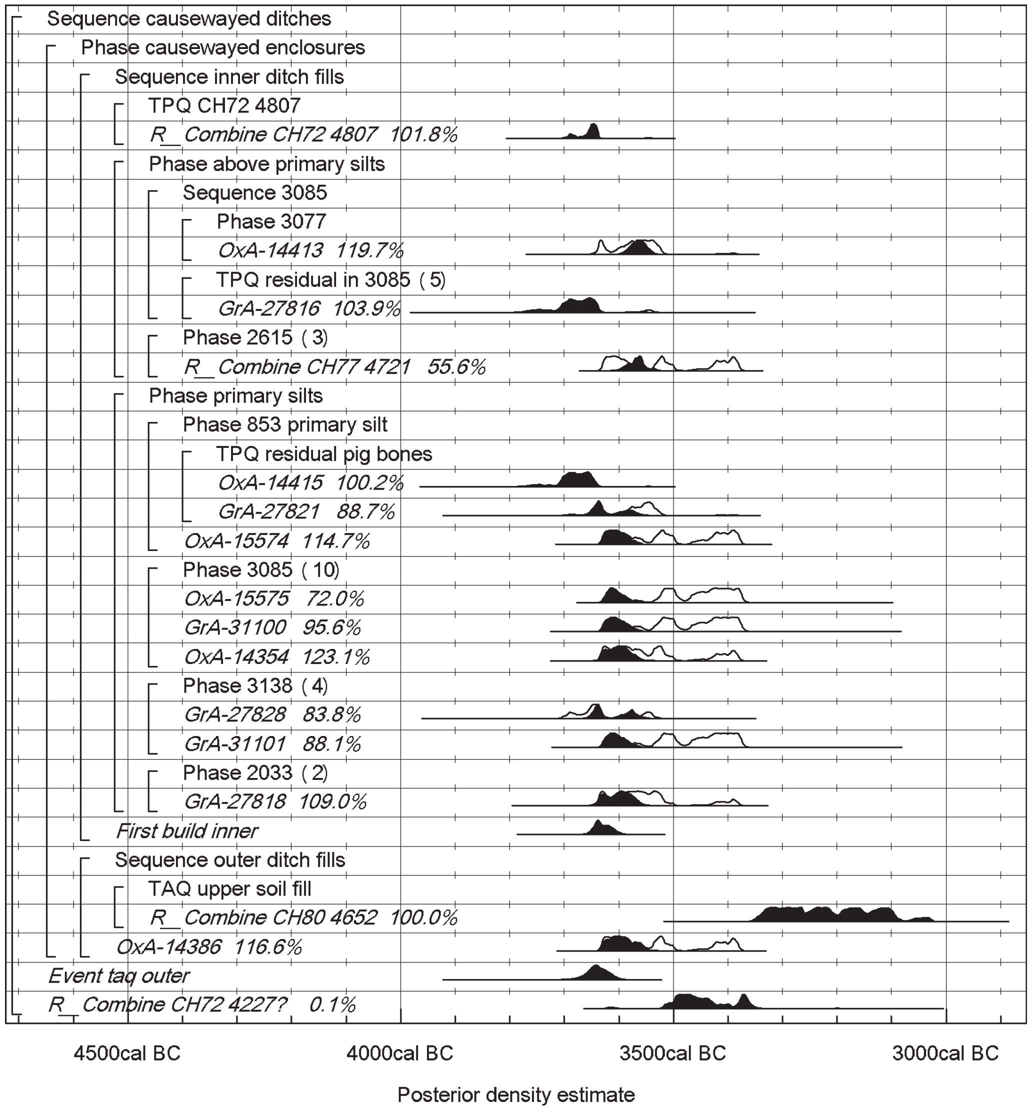


Fig. 9.9. Crickley Hill. Probability distributions of dates from the inner and outer circuits of the causewayed enclosure. The format is identical to that of Fig. 9.8. The overall structure of this model is shown in Fig. 9.7, and its other components in Figs 9.8 and 9.10.

and that the intervening causeways had been removed. The upcast from the ditches had been formed into a platform-like internal bank. This bank respected the position of three broad causeways on the eastern side of the site, and here it was clear that there had been entrances. Elsewhere, the bank continued behind the causeways. In the north-east of the circuit this bank sealed the banana barrow. The stratification within the segments proved complex and was not identical from segment to segment. Almost all, however, showed clear signs of level infilling, presumably from the bank, succeeded by a partial recutting of the ditch. Though it is natural to see the re-formation of the ditch as a single event, this can hardly be demonstrated. Cultural material was not abundant, although there were certain clear signs of deposition.

Groups of samples were available from two segments, 853 and 3085. In 853, three samples were dated from the primary silts at the base of the ditch. The measurements on these samples are not statistically consistent, a roe deer antler (*OxA-15574*) being younger than two fitting pig epiphyses (Table 9.2: *OxA-14415*, *GrA-27821*; T'=14.0; T'(5%)=6; ν=2). In layer 10 of 3085, three more samples were dated from the initial silts. These three measurements, two on disarticulated animal bones (*GrA-31100*, *OxA-15575*) and one (*OxA-14354*) on residue from a single sherd, are statistically consistent (Table 9.2; T'=1.1; T'(5%)=6.0; ν=2). Two further samples from the primary silt, a disarticulated animal bone and residue from a single sherd, have been dated from layer 4 of 3138 (Fig. 9.9: *GrA-31101, -27828*). Finally, a probably articulating sample was dated from the initial silt of segment 2033 (Fig. 9.9: *GrA-27818*). The nine measurements from the initial silts are not statistically consistent (T'=33.4; T'(5%)=15.5; ν=8), the pig bones with fitting epiphyses from 853 being rather earlier than the rest. If these measurements (*OxA-14415* and *GrA-27821*) are excluded, however, the remainder form a consistent group (T'=11.2; T'(5%)=12.6; ν=6). This suggests that the pig bone from 853 may have been redeposited, but that

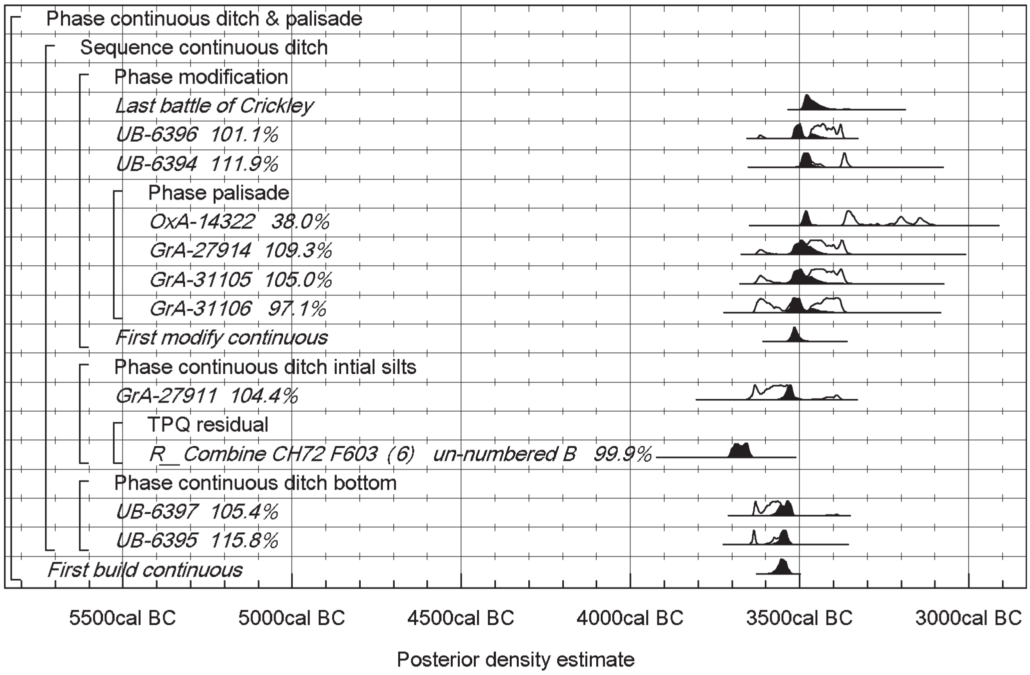


Fig. 9.10. Crickley Hill. Probability distributions of dates from the continuous ditch. The format is identical to that of Fig. 9.8. The overall structure of this model is shown in Fig. 9.7, and its other components in Figs 9.9–10.

the other material was probably fresh when deposited in the ditch. For this reason, the model shown in Fig. 9.9 uses *OxA-14415* and *GrA-27821* as *termini post quos* for 853(3), with the other samples providing direct dates for these initial silts.

Four samples have been dated from later fills in the circuit. Residue from a sherd in layer 5 of 3085 (Fig. 9.9: *GrA-27816*) must be redeposited, since it has poor agreement when constrained to be later than the samples from the initial silts of the same segment (A=11.8%). In 3077, a subsequent recut in 3085, an articulating sample (*OxA-14413*) must be later than all the material from the initial silts. A second articulating sample from the upper fills of 2615 (*CH77 4721*) must also be later than the material from the initial silts. A third bone sample (*CH72 4807*) from the upper fills is problematic. This is a pig femur with fitting epiphysis, which is older than 602(3), the context from which it was recovered (A=6.4%). The layer in question represents the final infill of the inner causewayed ditch which is sealed by the lower levels of the subsequent Neolithic bank (phase 1d). The mode of filling this depression before the construction of the later bank was certainly the levelling of the previous monument using material presumably derived from the causewayed enclosure bank. Thus, it is reasonable to see this small sample as having come, together with the stone slabs which form its context, from the adjacent early bank. In these circumstances, the correspondence of the date of this sample with those which mark the construction of this early causewayed circuit is entirely reasonable. This sample does, however, provide a *terminus post quem* for the subsequent continuous circuit.

On this basis, the model shown in Figs 9.7 and 9.9 suggests that the inner causewayed circuit was built in *3660–3595 cal BC* (*95% probability*; Fig. 9.9: *build inner*), probably in *3650–3610 cal BC* (*68% probability*). In the west of the circuit, the continuous ditch and its bank stratigraphically post-date the inner circuit (Fig. 9.4).

The continuous ditch. The segments of the continuous ditch were larger than those of the inner circuit, measuring about 2.5 m in width and almost as much in depth. The only gaps in its circuit were those occupied by formally built entrances. Its alignment corresponded closely to that of the inner causewayed circuit; indeed, on two occasions, the builders of the continuous ditch broke into the outer side of the inner causewayed ditch, and then without fully excavating that closed their intrusion with a dry stone wall. We discuss the possible significance of this below. The continuous ditch probably formed a complete circuit. Stratification within this ditch was more uniform than in the inner causewayed circuit, and consisted in the main of a natural slumping from the inner side of the ditch, leaving a markedly asymmetrical profile. This suggests that the infill was largely from the outer edge of the bank. After a considerable amount of further infill had accumulated, the ditch was recut towards its outer edge with a narrow trench.

Two statistically consistent measurements (Fig. 9.10: *UB-6395*, *-6397*) have been obtained on groups of articulating cattle bone from the ditch base (Table 9.2; T'=1.2; T'(5%)=3.8; ν=1). On the base of segment 603 was a discrete patch of silt containing an unusually high proportion of charcoal. Two fragments were dated from this deposit (Fig. 9.10: *GrA-27911, CH72 F603*(*6*) *un-numbered B*), producing significantly different measurements (T'=6.8; T'(5%)=3.8; ν=1). *CH72 F603*(*6*) *un-numbered B* has poor

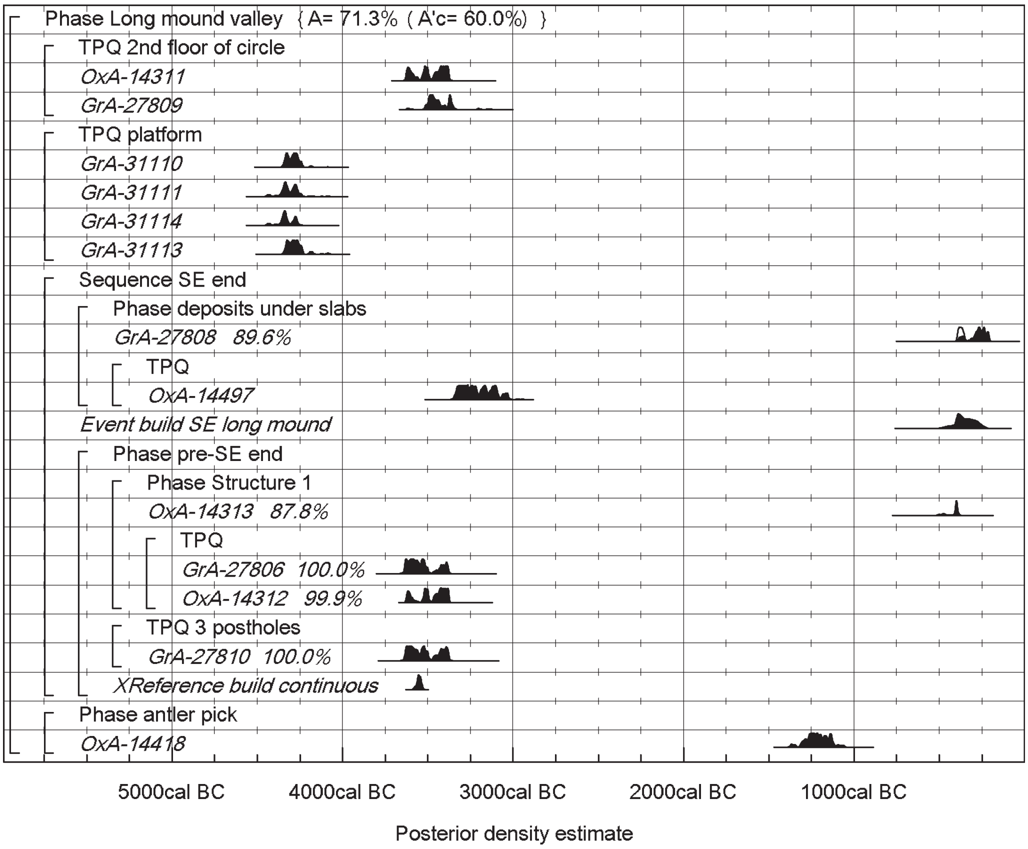


Fig. 9.11. Crickley Hill. Probability distributions of dates from the long mound valley. The format is identical to that of Fig. 9.8. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

agreement when its stratigraphic relationship with the articulated samples from the ditch base is included in the model (A=0.0%). For this reason, this sample is used as a *terminus post quem* for the layers above.

A complete, well preserved cattle tibia was dated from the base of a recut in 2659 (Fig. 9.10: *UB-6396*). This modification of the circuit may have involved the extension of the bank, since a statistically consistent result (T'=3.4; T'(5%)=3.8; ν=1) has been obtained for articulating cattle lower leg bones from the tail of the bank (Fig. 9.10: *UB-6394*). These two samples are significantly later than the articulating cattle remains from the base of the ditch, suggesting that this deposit in the bank forms part of a later modification rather than original construction, and so linking the two events of the recutting of the ditch and the remodelling of the bank appears plausible.

The bank behind the continuous ditch formed a low platform, at the rear of which was a series of postholes and grooves which formed a palisade. All these features had clearly been burnt, leaving a dark red scorching on the limestone, and they contained quantities of charcoal. Four statistically inconsistent radiocarbon determinations have been obtained on short-lived fragments of charcoal from the palisade (T'=8.9; T'(5%)=7.8; ν=3), although the differences between these measurements are such that they might be accounted for by the inherent variability of even short-lived wood samples. Again, it seems reasonable to interpret the construction of this palisade as part of the same modification to the continuous ditch and its bank.

According to the model shown in Figs 9.7 and 9.10, the continuous circuit was constructed in *3580–3525 cal BC* (*95% probability*; Fig 9.10: *build continuous*), probably in *3565–3535 cal BC* (*68% probability*), and was modified in *3535–3485 cal BC* (*95% probability*; Fig. 9.10: *modify continuous*), probably in *3525–3500 cal BC* (*68% probability*).

Some time after the palisade was completed, it was thoroughly burnt around the whole of the circuit and scores of leaf arrowheads were found in direct association (see above), about 25 of them burnt and lying in the groove of the palisade. This conflagration may be associated with the burning of all the internal structures of the enclosure, a fire which was similarly associated with leaf arrowheads. The dates from the palisade suggest that this conflict occurred after *3495–3410 cal BC* (*95% probability*; Fig. 9.10: *battle of Crickley*), probably after *3490–3450 cal BC* (*68% probability*). Although the dates of the palisade provide only a *terminus post quem* for this conflict, the palisade, exposed to the elements, is unlikely to have survived unrotted for longer than a decade or so (Reynolds 1993, 101–12).

An antler pick found on the track through the east entrance in the continuous ditch was thought to date to the abandonment of that earthwork, since it would not have survived being trampled on a regularly used route.

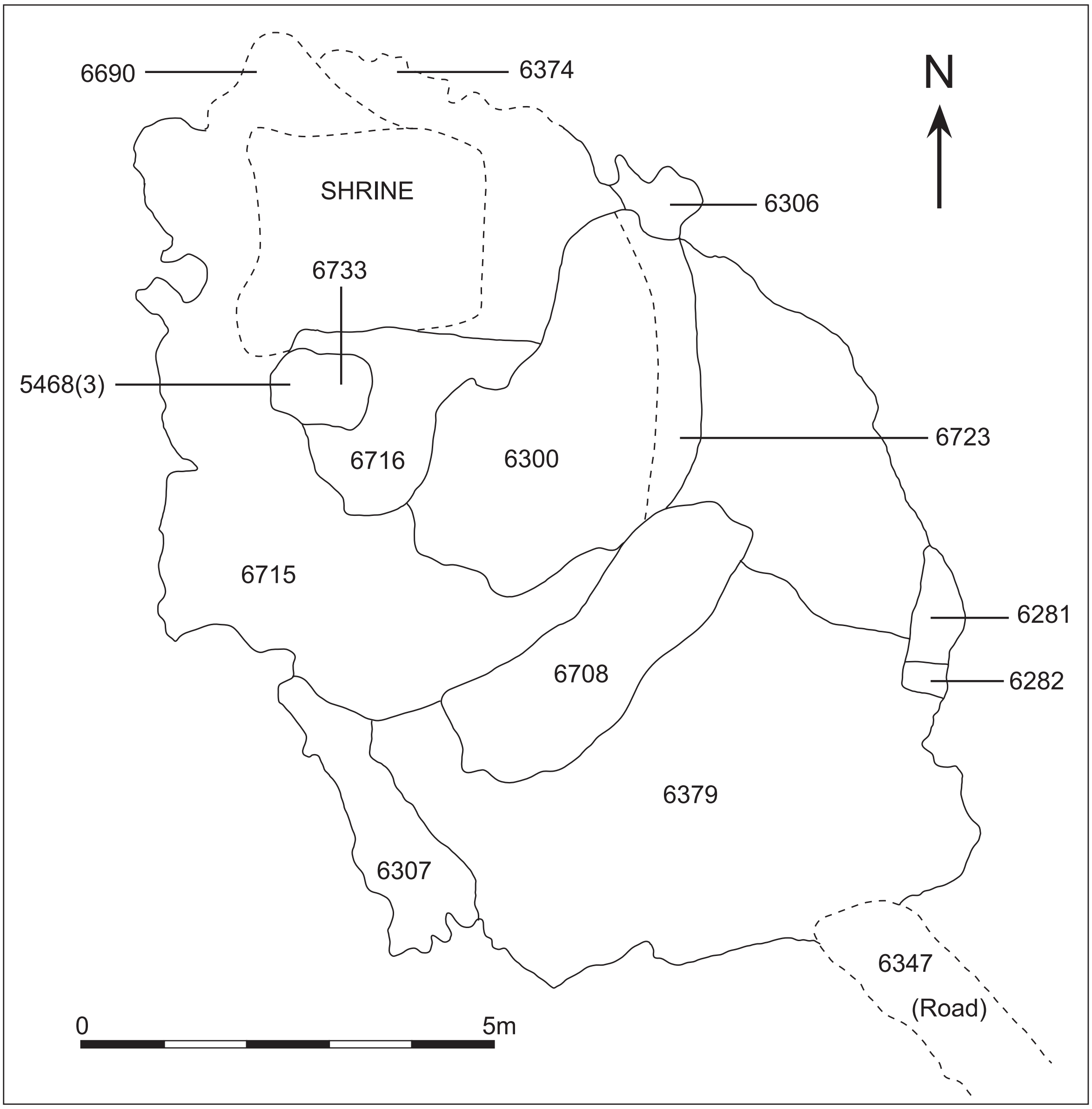


Fig. 9.12. Crickley Hill. The platform underlying the circle which in turn underlay the north-west end of the long mound. 6379 is the area of tightly packed limestone rubble which was the context of the samples for GrA-31110–11 and -31113–14. After Snashall (1997, fig. 7).

It dates, however, to the later second millennium cal BC (Table 9.2: OxA-14418).

The long mound valley. Here the sequence is complex and potentially extended (Table 9.1). At the north-west end, the earliest element was a platform built of dumps of limestone rubble (Fig. 9.12), one of which contained hazel charcoal fragments. Four of these were dated, yielding statistically consistent results (Table 9.2: *GrA-31110–11*, *-31113–14*; T'=1.4; T'(5%)=7.8; ν=3), dating to the third quarter of the fifth millennium cal BC (Fig. 9.11). This context consisted of a horizontal area of tightly packed cobbling measuring some 5 m by 3 m, one of several such paving a platform on which there was a rectangular structure which has been interpreted as a shrine (Snashall 1997, 12–15, figs 7–9). It is hard to argue that the platform belongs to the early period indicated by the dates, because it was outlined by a series of fences which are aligned on an entrance of the continuous ditched enclosure which was constructed in the mid-36th century cal BC. The rubble collected to build this element of the platform could have incorporated charcoal from the adjacent, pre-enclosure, occupation evidenced by sub-circular, stake-built structures sealed beneath the platform itself and beneath the bank of the outer causewayed circuit, which appear to be Mesolithic. The samples thus provide *termini post quos* for the building of the platform, whose date would best be indicated by the alignment of its fences on the continuous ditched enclosure, as set out above.

The north-west end of the long mound was subsequently built over the edge of the platform and in turn truncated by the construction of a small stone circle, which itself went through at least two building periods. A concentration of charred plant material on the second floor of the circle

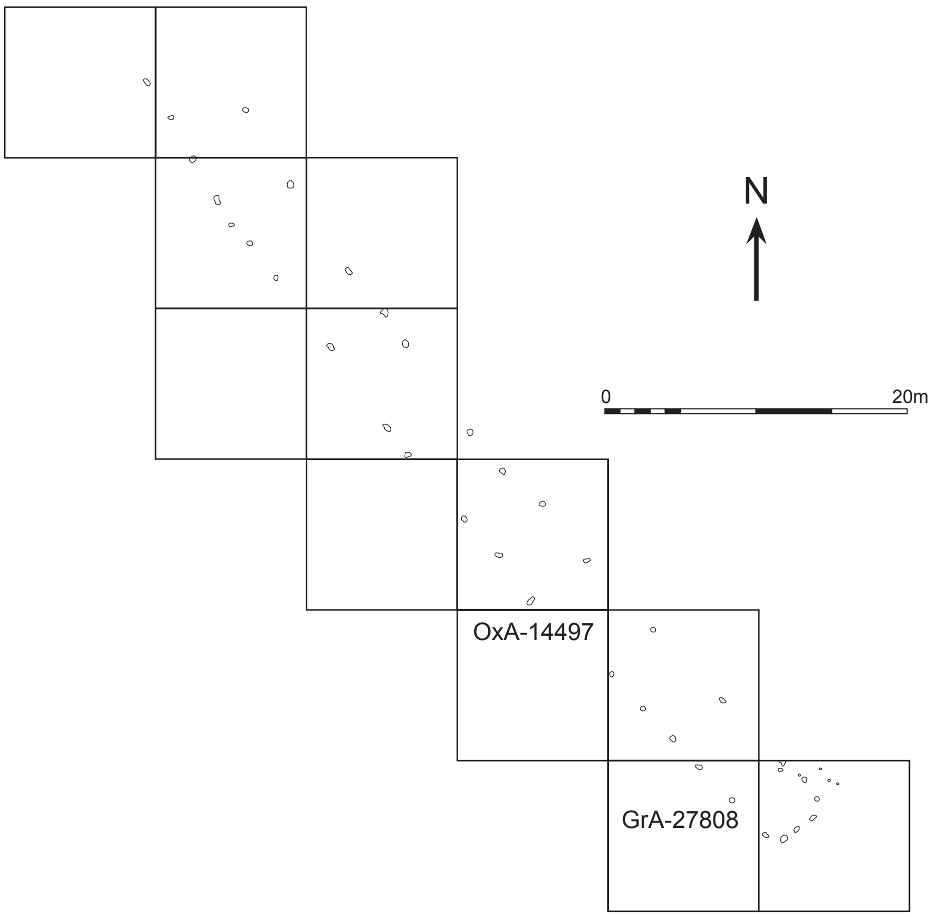


Fig. 9.13. Crickley Hill. The long mound, showing stone slabs and location of samples for GrA-27808 (under slab 2717) and OxA-14497 (under slab 2792). After Hollos (1999, fig.166).

included hazelnut shell fragments, two of which have yielded statistically consistent radiocarbon measurements, dating to the mid-fourth millennium cal BC (Fig. 9.11; Table 9.2: *GrA-27809*, *OxA-14311*; T'=2.1; T'(5%)=3.8; ν=1). Given the comminuted condition of the shells and the number of stratigraphic layers between the top of the platform (argued above to belong to site phase 1d) and the second development of the circle, it seems prudent to treat these samples as residual, and as providing only *termini post quos*.

No samples could be located from the central section of the long mound, which was built on to the tail of the north-west section. Six samples related to the south-east and final section of the long mound, which was in turn built on to the tail of the central one. Four came from features sealed beneath the mound, all of which were likely to be post-Neolithic. *GrA-27810* (Fig. 9.11) came from F2830, one of a row of three postholes across the end of the valley (Dixon 1988a, fig. 4.6), another of which (F2825) contained a small fragment of a grog-tempered flat rim. *GrA-27806* and *OxA-14312* (Fig. 9.11) came from F2835, a posthole of a rectangular structure (structure 1) beside and parallel to a stake-lined track leading from an entrance in the continuous enclosure to the platform (Dixon 1988a, fig. 4.3; Snashall 1998, 16–20, figs 13–18). *OxA-14313* (Fig. 9.11) came from F2806, a second posthole of structure 1, sherds from which include two fragments of a grog- and possibly flint-tempered protruding base angle as well as heavily gritted fragments including a base angle and body sherd with an incised chevron. Sherds from F2802, a third posthole of the structure, included a grog- and flint-tempered body fragment. All this pottery appears to be of second or first millennium BC date. The postholes of structure 2, on the same alignment as and immediately to the north-west of structure 1, also contained second or first millennium pottery.

The disarticulated sample from F2806 was of mid-first millennium cal BC date (Table 9.2: *OxA-14313*). The other two dates from structure 1, one of them on an articulating sample (Table 9.2: *OxA-14312*, *GrA-27806*), both fell in the mid-fourth millennium cal BC and were statistically consistent with each other and with the sample from F2830 (Table 9.2: *GrA-27810*; T'=0.9; T'(5%)=6.0; ν=2). *OxA-14313* and the pottery together suggest that structure 1 was of first millennium cal BC date and hence that the final section of the long mound was built in or after this period. The presence of fourth millennium cal BC bone in another posthole of the structure and in one of the row of three postholes to the south-east may simply reflect the proximity of the Neolithic ditches and pits.

Stratified above these structures were two bone deposits placed beneath stone slabs set into the south-east end of

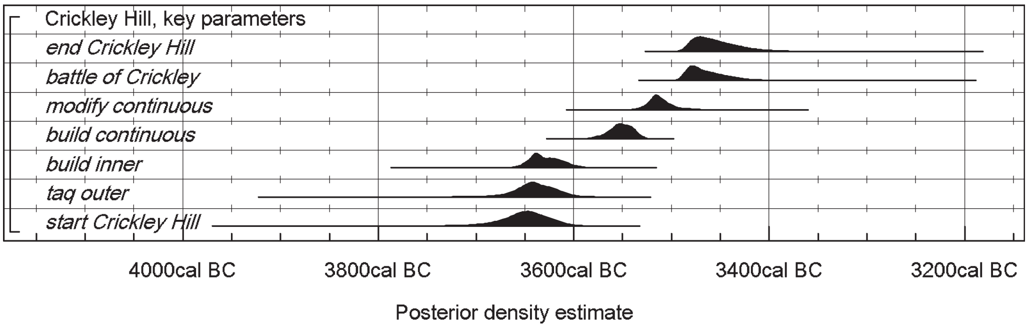


Fig. 9.14. Posterior density estimates for the construction of the Neolithic earthworks on Crickley Hill, derived from the model shown in Figs 9.7–10.

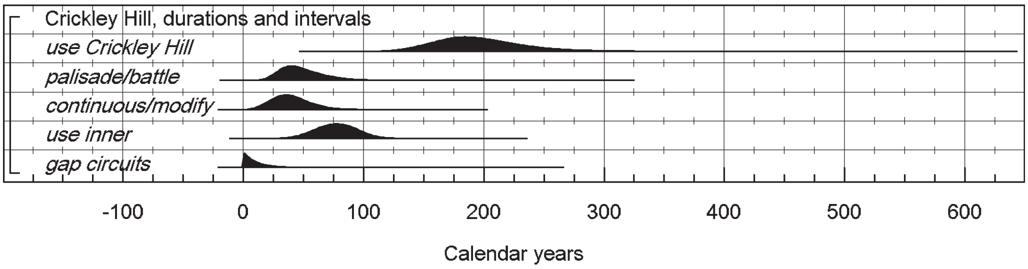


Fig. 9.15. Crickley Hill. Probability distributions of the number of years between key parameters, derived from the models shown in Figs 9.7–10.

the long mound (Fig. 9.13). One of these, consisting of eroded cattle bone broken when already old, dated to the late fourth millennium cal BC (Table 9.2: *OxA-14497*); the other, a pig mandible, dated to the later first millennium cal BC (Table 9.2: *GrA-27808*). The slabs covering both formed part of a more extensive setting around the entire long mound (Hollos 1999, 39–40, 327, 343), and it seems that already old bone was in one case placed under a slab. Only *OxA-14313* and *GrA-27808* can be used to indicate the construction date of the final section of the long mound. These results suggest that the final section of the long mound was completed in *465–235 cal BC* (*95% probability*; Fig. 9.11: *build SE long mound*), probably in *405–285 cal BC* (*68% probability*).

There was a human presence on Crickley Hill from the fifth millennium cal BC. Groups of samples dated to this period have been recovered from the banana barrow and context 6379 in the paving of the platform (Fig. 9.12). Whether these measurements date the two constructions is discussed above. In the case of the banana barrow, they may suggest construction in *4640–3970 cal BC* (*95% probability*; Fig. 9.8: *build banana barrow*), probably in *4185–3990 cal BC* (*68% probability*). The interval between *build banana barrow* and enclosure construction (*start Crickley Hill*) is *285–1010 years* (*95% probability*; distribution not shown) or *335–550 years* (*68% probability*).

A summary of the chronology of the Neolithic enclosures on Crickley Hill is provided in Fig. 9.14. The dating for the outer circuit of the causewayed enclosure is based on regrettably few samples, but its construction can be estimated to have occurred in or shortly after *3685–3595 cal BC* (*95% probability*; Fig. 9.14: *taq outer*), probably in *3660–3615 cal BC* (*68% probability*). The inner circuit of the causewayed enclosure was built in *3660–3595 cal BC* (*95% probability*; Fig. 9.14: *build inner*), most probably in *3650–3610 cal BC* (*68% probability*). Our preferred model incorporates the archaeological interpretation that the outer circuit was constructed before the inner circuit, but the model estimates the inner circuit to have been built *0–35 years* after the outer one (*95% probability*; Fig. 9.15: *gap circuits*), probably *0–15 years* later (*68% probability*). It is possible that the two circuits are precisely contemporary, but at most they are separated by a generation.

The inner circuit of the causewayed enclosure was in use for no more than *40–115 years* (*95% probability*; Fig. 9.15: *use inner*), probably for *55–95 years* (*68% probability*). The activities clearly visible in the stratification of this ditch involved infilling and recutting on at least two and perhaps three occasions within this period. Once the inner circuit had been filled, a more continuous ditch circuit was constructed in *3580–3525 cal BC* (*95% probability*; Fig 9.14: *build continuous*), probably in *3565–3535 cal BC* (*68% probability*). The defences of the continuous ditch circuit were modified in *3535–3485 cal BC* (*95% probability*; Fig. 9.14: *modify continuous*), probably in *the last quarter of the 36th century cal BC* (*68% probability*). This occurred *10–75 years* after the defences were first constructed (*95% probability*; Fig. 9.15: *continuous/modify*), probably after *20–55 years* (*68% probability*). At least *15–95 years* (*95% probability*; Fig. 9.15: *palisade/battle*), probably *25–65 years* (*68% probability*), then elapsed before the total destruction of the defences, and perhaps of much of the interior, by fire. This violent episode occurred in or after *3495–3410 cal BC* (*95% probability*;

Fig. 9.14: *battle of Crickley*), probably in *3490–3450 cal BC* (*68% probability*).

Overall, the Neolithic enclosures on Crickley Hill were in use between *3705–3600 cal BC* (*95% probability*; Fig. 9.7: *start Crickley Hill*), and *3495–3395 cal BC* (*95% probability*; Fig 9.7: *end Crickley Hill*), probably between *3670–3620 cal BC* and *3485–3440 cal BC* (*68% probability*). The complex was in use for *125–285 years* (*95% probability*; Fig. 9.15: *use Crickley Hill*), probably for *150–225 years* (*68% probability*).

Sensitivity analyses

Many variants of the model presented above were constructed during the process of modelling the chronology of Crickley Hill. Two of these are presented here to provide a sense of the scale of the differences in the date estimates provided by these alternative models.

The model presented in Figs 9.7–10 was re-run, with the two pig bone samples from the primary silt of the inner ditch (853) included as freshly deposited (OxA-14415, GrA-27821). This is not impossible, although in this scenario, because of the difference between these measurements and that on the antler from the same context (OxA-15574), for some reason the primary silt in this segment would have had to have taken an unusually long time to accumulate. This model suggests that the inner ditch of the causewayed enclosure was excavated in *3690–3635 cal BC* (*95% probability*; distribution not shown), probably in *3665–3640 cal BC* (*68% probability*), approximately a generation earlier than the estimates provided by the model previously presented (*3660–3595 cal BC at 95% probability*; *3650–3610 cal BC at 68% probability*; Fig. 9.14: *build inner*).

The second variant model has the overall structure shown in Fig. 9.7, with the structures of the component sections shown in Figs 9.8, 9.10 and 9.21 (although only the posterior density estimates shown in Fig. 9.21 are those relating to this model). This reading does not incorporate as ‘prior information’ the interpretation of the excavator that the outer circuit of the causewayed enclosure was earlier than the inner circuit. This interpretation is compatible with the radiocarbon evidence as this variant model also has good overall agreement ($A_{overall}$=71.6%). It suggests that the outer circuit was constructed in *3665–3560 cal BC* (*95% probability*; Fig. 9.21: *taq outer*), probably in *3645–3590 cal BC* (*68% probability*), and that the inner circuit was constructed in *3665–3595 cal BC* (*95% probability*; Fig. 9.21: *build inner*), probably in *3650–3615 cal BC* (*68% probability*). According to this interpretation, the inner circuit was probably constructed before the outer (*78% probable*), the interval between their construction being *−25–70 years* (*95% probability*; distribution not shown), probably *−10–35 years* (*68% probability*) – within a single generation or so. Following this interpretation the estimated date for the construction of the outer circuit is perhaps a generation later, and any interval between the construction of the two circuits could be slightly longer (although the model still allows their construction to have been precisely contemporary).

9.2 Peak Camp, Cowley, Cheltenham, Gloucestershire, SO 92430 15020

Location and topography

Peak Camp (sometimes called Birdlip Camp) lies on a triangular promontory jutting north-west from the Cotswold escarpment, 1 km south-west of Crickley Hill (Fig. 9.1). Quarrying has lowered the tip of the promontory by about 3 m and eroded the north and south sides; the intact east area is contained within the 250 m OD contour. The promontory is cut off by two earthworks across the spur, about 90 m apart, with vestigial banks which appear virtually continuous (Fig. 9.16), although there is some doubt as to the authenticity of the inner one (Fig. 9.16; Oswald *et al.* 2001, 65). The outer would originally have enclosed an area of rather more than 1 ha. As at Crickley Hill, the earthworks probably defined an oval area within the promontory.

History of investigation

Two leaf-shaped arrowheads were found near the tip of the promontory in 1919. Two sections were cut by Darvill in 1980–1 (Darvill 1981; 1982a). Area I, across the outer earthwork, showed that only 0.30 m of rubble survived in the bank, beneath which there was no old land surface; that the ditch had at least three main phases and a fourth best described as a gully, having shifted position with each recutting (Fig. 9.17); and that there were Neolithic artefacts in all phases. Area II, dug near the surviving tip of the promontory in order to test for features in the interior, revealed an east-west ditch running more or less along the axis of the spur containing further Neolithic artefacts, including at least six leaf-shaped arrowheads, a flake from a Group VI axe and a shale arc-pendant. This ditch had been recut twice and was partly overlain by a 0.25 m-thick limestone platform and partly by burnt stones. It may be the western return of the outer earthwork boundary.

Previous dating

Six AMS dates were obtained soon after the excavation (Table 9.3: OxA-416–17, -444–6, -638; Darvill 1986; Gowlett *et al.* 1986). A further two were obtained in the course of subsequent analysis (Table 9.2: OxA-1525, -1622), as were two conventional dates (Table 9.2: Beta-141094–5). The samples for the first group included a pair of replicates (OxA-445–6) and were prepared and measured as described by Gillespie *et al.* (1984b) and Wand *et al*. (1984). Those for OxA-1525 and -1622 were dated as described by R. Hedges *et al.* (1989a). Those for Beta-141094 and -141095 were synthesised to benzene and measured by LSC, according to methods outlined at http://radiocarbon.com/analytic.htm.

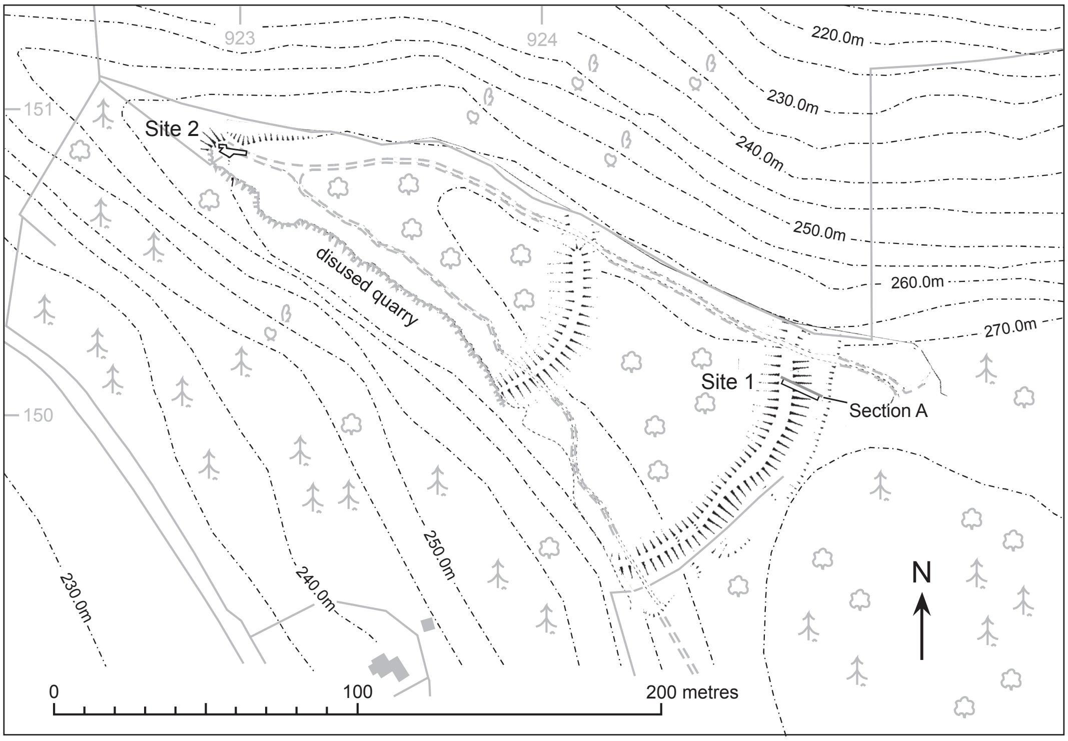


Fig. 9.16. Peak Camp. Plan showing cuttings. After Darvill (1981, fig. 1) and Oswald et al. *(2001, fig. 4.14).*

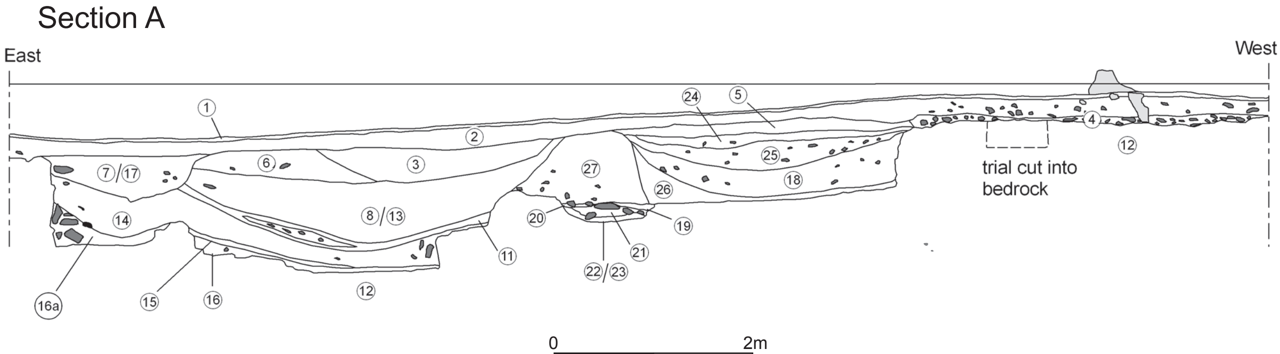


Fig. 9.17. Peak Camp. Section of Area I cutting. Bournemouth University School of Conservation Sciences.

Reassessment and modelling of existing dates

The ten samples provided sequences though both ditches. Neither reached to the bottom, although the Area I samples went well down the fills. All were disarticulated bone, and hence potentially redeposited. *Beta-141095* was clearly so, because it was older than samples stratified below it, and is therefore treated as a *terminus post quem* (Fig. 9.18). The others are in good agreement with the stratigraphy. The series can be modelled to indicate a construction date for the outer circuit of *3715–3490 cal BC* (*95% probability*; Fig. 9.18: *build outer Peak Camp*), probably of *3655–3540 cal BC* (*68% probability*). A continuation of activity to *3340–2585 cal BC* (*95% probability*; Fig. 9.18: *end Peak Camp*), probably to *3320–3150 cal BC* (*33% probability*) or *3070–2835 cal BC* (*35% probability*), is essentially based on *OxA-638* (Fig. 9.18), from the upper fill of a late ditch cut.

The construction date for the Area II ditch is more problematic, because all four samples are from recuts. The samples from context 15 could point to a *terminus post quem* for the first recut of *3755–3490 cal BC* (*88% probability*; Fig. 9.18: *tpq Area II, L15*) or *3460–3380 cal BC* (*7% probability*), probably of *3695–3625 cal BC* (*32% probability*) or *3600–3520 cal BC* (*36% probability*).

Objectives of the dating programme

The prime objectives were to refine these estimates of the date of earthwork construction, to permit comparison with the results from Crickley Hill, and to determine the duration of Neolithic use of the spur.

Table 9.3. Radiocarbon dates from Peak Camp, Gloucestershire. Posterior density estimates derive from the model defined in Fig. 9.19.

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
Area I								
GrA-30030	I 22 924 (a)	Cattle. Part of neural spine recently broken from young adult thoracic vertebra (926) from same context, which also contained 2 fragments of unfused epiphysis (936, 964), fitting the vertebra. Replicate of OxA-15284	Area I, phase I, layer 22. Initial silt on ditch base, underlying all other area I samples	4760±40	−22.7	4774±25 T'=0.2; T'(5%)=3.8; ν=1	3640–3510	*3640–3615* (*13%*) or *3610–3520* (*82%*)
OxA-15284	I 22 924 (b)	Replicate of GrA-30030	From the same context as GrA-30030	4782±31	−21.7			
OxA-15249	I 22 953	Sheep or goat. Tooth	From the same context as GrA-30030	4776±29	−21.4		3640–3380	*3640–3520*
GrA-30031	I 22 941	Pig. Fragment of radius	From the same context as GrA-30030	4790±40	−21.4		3650–3380	*3645–3520*
OxA-444	I 21 921	Single fragment of animal bone, not identified	Area I, phase I, layer 21. Rubble fill of first of three ditch cuts, overlying initial silt and, in places, ditch bottom. Stratigraphically earlier than samples for OxA-416–17, -445–6	4790±80	−19.0 (assumed)		3710–3360	*3590–3430*
OxA-445	I 20 873	Cattle. Bone from same mandible as tooth which was sample for OxA-446	Area I, phase I, layer 20. Overlying rubble fill in first of three ditch cuts. Stratigraphically equivalent to L19 and L10. Stratified above sample for OxA-444	4670±90	−19.0 (assumed)	4741±64 T'=1.2; T'(5%)=3.8; ν=1	3650–3360	*3545–3365*
OxA-446	I 20 873	Cattle. Tooth from same mandible as bone which was sample for OxA-445	From the same context as OxA-445	4810±90	−19.0 (assumed)			
OxA-416	I 20 872	Single fragment of animal bone, not identified	From the same context as OxA-445	4630±110	−19.0 (assumed)		3650–3020	*3545–3275*
OxA-15251	I 19 782 (b)	*Quercus* sp. sapwood. From same charcoal find as I 19 782 (a)	Area I, phase I, S face of trench, layer 19. Thin layer of burnt material overlying rubble fill in first of three ditch cuts. Stratigraphically equivalent to, though not continuous with, L10 in N face	4865±29	−26.1		3710–3630	*3705–3630* (*93%*) or *3550–3540* (*2%*)
GrA-30029	I 19 782 (a)	*Corylus avellana*. From same charcoal find as I 19 782 (b)	From the same context as OxA-15251	4825±40	−26.3		3700–3520	*3695–3620* (*39%*) or *3610–3520* (*56%*)
OxA-417	I 19 847	Single fragment of animal bone, not identified	From the same context as OxA-15251	4660±80	−19.0 (assumed)		3640–3120	*3540–3325*
GrA-30028	I 10 626 (a)	*Quercus* sp. sapwood. From same charcoal find as I 10 626 (b)	Area I, phase I, N face of trench, layer 10. Thin lens of burnt material overlying rubble fill in first of three ditch cuts. Stratigraphically equivalent to, though not continuous with, L19 in S face	5060±45	−25.1		3970–3710	*3965–3760* (*94%*) or *3725–3710* (*1%*)
OxA-15250	I 10 626 (b)	*Quercus* sp. sapwood. From same charcoal find as I 10 626 (a)	From the same context as GrA-30028	5060±29	−25.2		3960–3770	*3955–3785*

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-638	I 24	Single fragment of animal bone, not identified	Area I, phase II, layer 24. In upper fill of second or third of three ditch cuts, overlying layer 25, stratigraphically later than samples for OxA-416–17, -444–6	4290±80			3100–2670	*3495–3465 (2%)* or *3370–3205 (89%)* or *3190–3155 (1%)* or *3100–3050 (2%)* or *3025–2985 (1%)*
Area II								
Beta-141094	II 15 2590	Cattle. Metatarsal	Area II. F4. L15. Fill of first recut of ditch, in turn cut by second recut filled by L7. Stratified below samples for OxA-1525, Beta-141095	4910±120	−19.0 (assumed)		3970–3370	*3765–3490 (89%)* or *3470–3385 (6%)*
OxA-1622	II 15 2095	Single fragment of animal bone, not identified	From the same context as Beta-141094	4865±80	−21.0		3800–3380	*3760–3495 (94%)* or *3430–3400 (1%)*
OxA-1525	II 7 564	Single fragment of animal bone, not identified	Area II, F4, L7. Fill of second recut. Stratified above samples for OxA-1622, Beta-141094	4750±150	−21.0		3910–3090	*3650–3260*
Beta-141095	II 7 4522	Cattle. Radius	From the same context as OxA-1525	5470±170	−19.0 (assumed)		4690–3950	*4695–3955*

Sampling strategy

Sampling was restricted by the limited scale of the excavation. The only suitable sample from the Area II ditch was from a layer no farther down the sequence than the samples for the existing dates and, in the event, no additional samples were dated from that feature.

In the outer enclosure ditch in Area I, no articulating samples could be found, but three bone samples of different species, and hence not from the same animal, from the initial silts (Fig. 9.17: context 21) included a cattle vertebra with a fitting, unfused epiphysis. Above the rubble fills, two stratigraphically equivalent lenses of burnt material (Fig. 9.17: contexts 10, 19) provided short-life charcoal samples.

Results and calibration

Full details of all the measurements from the site are listed in Table 9.3 and shown in Fig. 9.19.

Analysis and interpretation

In the outer ditch, four radiocarbon determinations have been obtained from the three samples from the initial silts (Fig. 9.19: *I 22 924, OxA-15249, GrA-30031*). These results are statistically consistent (T'=0.3; T'(5%)=7.8; ν=3) and in good agreement with all the disarticulated bone samples from the overlying layers (Fig. 9.19). Oak sapwood from a lens of burnt material above the rubble fills (context 10; Fig. 9.19: *GrA-30028, OxA-15250*), however, is older than disarticulated bone samples from underlying layers, as is oak sapwood and hazel charcoal from context 19, though less markedly so (Fig. 9.19: *GrA-30029, OxA-15251*). Since neither deposit was burnt *in situ*, these samples may have been of some age when they entered the ditch, and the measurements are treated as *termini post quos* for the layers above them. The model suggests that the outer circuit was built in *3650–3550 cal BC* (*95% probability*; Fig. 9.19: *build outer Peak Camp*), probably in *3640–3620 cal BC* (*30% probability*) or *3605–3570 cal BC* (*38% probability*). Since no suitable samples could be found from the lower part of the sequence in Area II, the construction date of that ditch remains uncertain. The end of the primary use of the site occurred in *3485–3460 cal BC* (*1% probability*; Fig. 9.19: *end Peak Camp*) or *3360–2965 cal BC* (*94% probability*), probably in *3330–3215 cal BC* (*68% probability*). Again, this estimate is heavily dependent on *OxA-638*, a bone from a late recut of the outer ditch (Table 9.3).

9.3 Implications for the escarpment

In this section we will take Crickley Hill and Peak Camp together, though keeping it as an open question whether they belong together in a single complex as at Hambledon Hill (Chapter 4).

The first point to underline is the documentation through the dating programme of a human presence in the late fifth

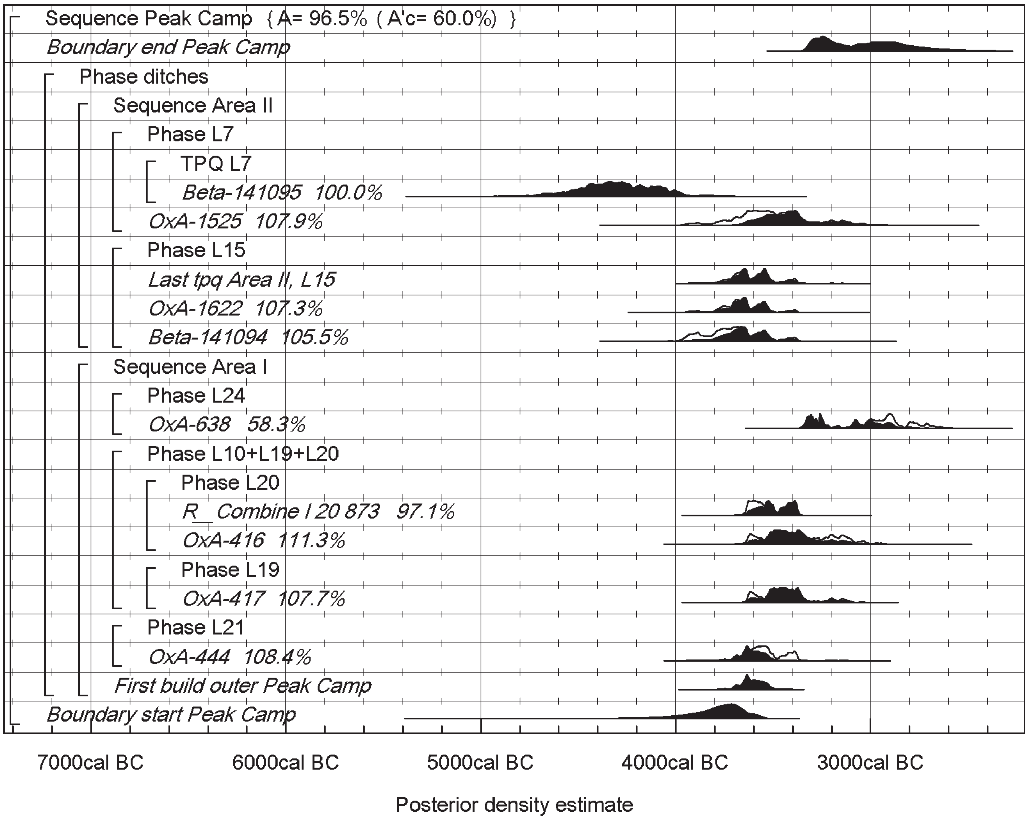


Fig. 9.18. Peak Camp. Probability distributions of radiocarbon dates obtained before 2005. The format is the same as for Fig. 9.8. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

millennium cal BC on Crickley Hill. Other evidence for late Mesolithic activity in the Cotswolds is noted below. The information from Crickley Hill adds to the diversity of late Mesolithic situations with which this project has engaged, from the low density in the upper Kennet and the Maiden Castle area to the abundant record of Cranborne Chase relatively close to Hambledon Hill (Chapters 3 and 4). Flints of Mesolithic character from the Crickley Hill excavations amount to at least 50 pieces and there were two certain and three possible sub-circular huts, arranged in a rough arc, two below the bank of the outer causewayed circuit, and two below the shrine of site phase 1d. As at Hazleton and Ascott-under-Wychwood to the north-east along the Cotswolds (Saville 1990; Meadows *et al.* 2007; Benson and Whittle 2007), the fact that a late Mesolithic presence was followed at an interval by concentrated Neolithic activity raises the question of whether there is any connection between the two. After all, late Mesolithic people might have used the escarpment for the same views and visibility that were afforded to their Neolithic successors.

The interval between the late fifth millennium cal BC activity and the beginning of the causewayed enclosure (site phase 1b) is around 400 years (*335–550 years* (*68% probability*; distribution not shown, see above)). Perhaps that is too long for active memories (R. Bradley 2002, 14–16; Whittle 2003, 105–32). In this case, however, the dating programme has thrown up the intriguing possibility that there were potentially late fifth millennium structures, in the form of the banana barrow and the huts underlying the outer causewayed circuit and the platform, as well as activity of the same period at Peak Camp (Fig. 9.19: Beta-141095). We have set out above the difficulties in interpreting the samples from the banana barrow. Whatever the cultural affiliations of its builders and users, its continued visibility could have been one way in which memories and stories of this particular place could have been maintained, leading to its subsequent selection as the site of the causewayed enclosure.

Some claims for Mesolithic constructions elsewhere have proved to be unsupportable, as in the case of Carrowmore, Co. Sligo (Chapter 12; Burenhult 1980; 1984; Grogan 1991); but there is nothing inherently problematic in the possibility (R. Bradley 1993). Mesolithic people dug pits, cleared trees and otherwise modified their surroundings; their earthmoving techniques were probably little different to those of the early Neolithic (Allen and Gardiner 2002). The construction of a low mound from surrounding pits cannot have been a difficult task. What its connotations may have been is very hard to say, but the possibility of changes of worldview in this period is at least open to discussion, and it is sobering to reflect that it has taken such an extended and extensive excavation to produce even this limited amount of evidence.

Once the decision had been taken to begin the project of the causewayed enclosure, which of its two circuits

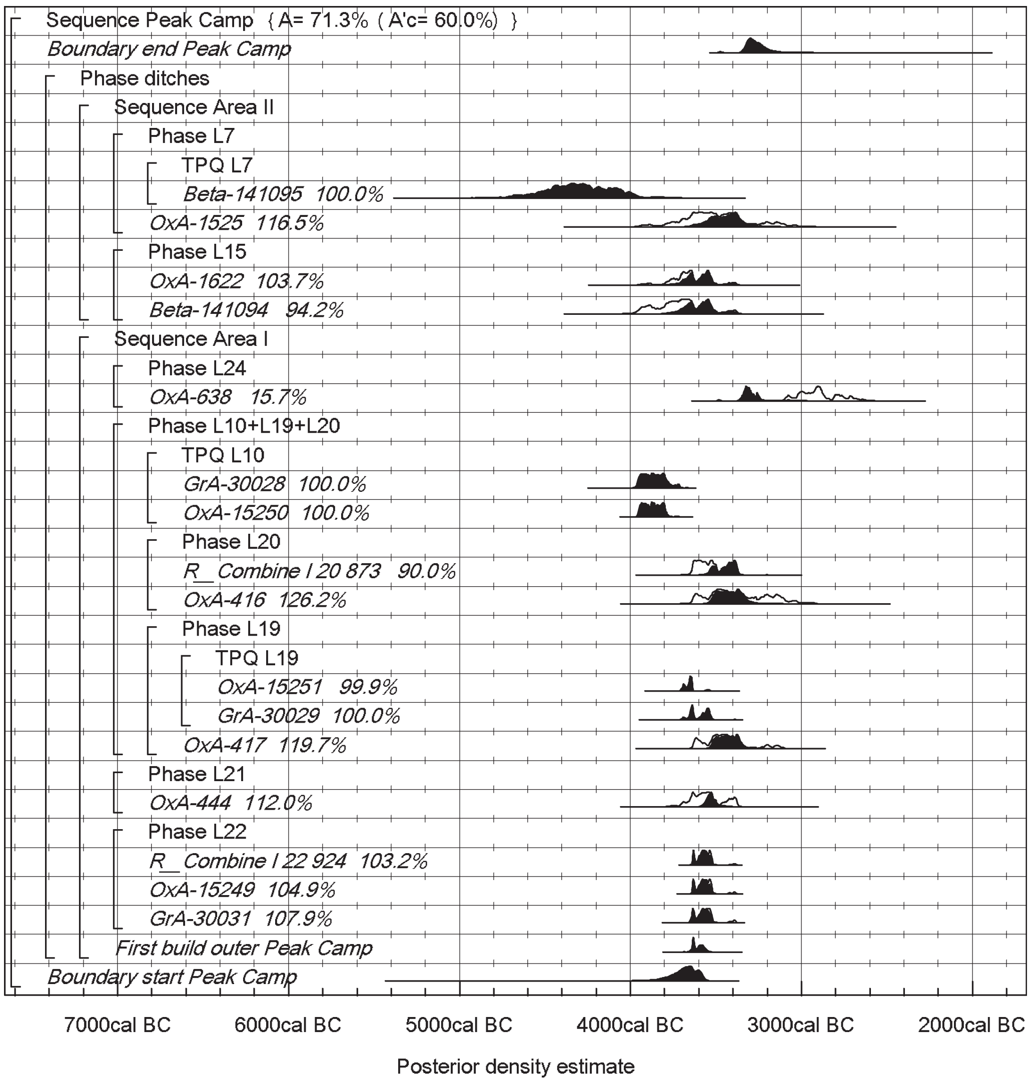


Fig. 9.19. Peak Camp. Probability distributions of radiocarbon dates. The format is the same as for Fig. 9.8. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

came first? As seen above, our main model incorporates the archaeological interpretation that the outer circuit was built before the inner, because what was seen as the earliest entrance in the inner circuit was linked, by a roadway and fences, to what was seen as the already slightly modified outer ring (Dixon 1988a, 78; site phase 1b(i) followed by site phase 1b(ii)). The main model also allows for the two causewayed circuits to be of the same date. A variant model, which does not incorporate this inferred relationship, also has good overall agreement ($A_{overall}$=71.6%) and so is also perfectly feasible. The resulting picture – in both of these models – of the rapid construction of both circuits within at most a generation or two may be the important result.

In contrast to many other enclosures, both the causewayed enclosure and the continuous enclosure at Crickley Hill contained only small amounts of material deposited as rubbish or placed in significant contexts. The most obvious of these were two foundation deposits of bones in hollows at the terminals of the main segments of the continuous ditch. This suggests differences in the use of the enclosures.

The causewayed enclosure – at least its inner circuit – at Crickley Hill was probably in use for *55–95 years* (*68% probability*; Fig. 9.15: *use inner*). This span makes the relatively low quantities of material deposited in the ditches all the more striking, but given the episodes of recutting and modification within the ditches, there was enduring interest in the circuits themselves. This may explain the striking feature of the succeeding ditch having respected the line of the causewayed circuits at two points, to the extent that where the diggers of the continuous ditch had – presumably inadvertently – dug into the infilled inner causewayed ditch, they had walled the cut back up (Fig. 9.5). Perhaps at this site some notion of burying the ditches themselves, rather than the materials more usual elsewhere, held sway.

There was almost certainly no substantial gap between the end of deposition in the causewayed enclosure ditches and the construction of the continuous ditched circuit. The model is compatible with the archaeological evidence for backfilling noted above on this point. There is no obvious reason – for example in the character of the finds – to suppose any discontinuity in the identity of the population

using Crickley Hill at this stage. It is more convincing to think of changing local or regional circumstances in the mid-36th century cal BC (*3565–3535 cal BC*; *68% probability*; Fig. 9.14: *build continuous*), which required a more effective barrier. That may well be connected with the threat of a greater frequency of inter-personal or inter-communal violence. The reality of such a threat appears to be underlined by the remodelling of the continuous circuit after a generation or two (*20–55 years* (*68% probability*; Fig. 9.15: *continuous/modify*) – conceivably the duration of its initial woodwork – and then by the final destruction by fire after another generation or two (*25–65 years*; *68% probability*; Fig. 9.15: *palisade/battle*).

This timescale from Crickley Hill is important for putting the possible nature and scale of inter-personal and inter-communal violence into context. It indicates vividly that there was a threat or a perception of threat from others, whether constant or intermittent, over several generations. We know from the Cotswold long barrows of individual instances of inter-personal violence: a man from Ascott-under-Wychwood shot by an arrow (Galer 2007; Knüsel 2007) or individuals with head injuries of varying severity at Belas Knap, West Tump, Rodmarton and Lugbury (Schulting and Wysocki 2005). The Ascott-under-Wychwood man died probably in the first half of the 37th century cal BC (Bayliss *et al*. 2007c, fig. 7: *GrA-25304*), and might be taken as evidence of episodic or endemic inter-personal conflict; we come back to the question of how to estimate the scale of violent episodes in Chapter 15. At Crickley Hill, however, the principal evidence of actual conflict consists of the final attack and conflagration, in the first half of the 35th century cal BC (*3490–3450 cal BC*; *68% probability*; Fig. 9.14: *battle of Crickley*). It is clear that, by this time at least, conflict occurred between groups as well as between individuals.

At least 380 leaf arrowheads were found associated with the final layers of the continuous ditch, its bank, and its interior works. These were concentrated on two of the three entrances, where each passageway was thronged with thirty to forty arrowheads, and on the palisade at the rear of the bank. Two dozen of the arrowheads along the line of this had been burnt, and most displayed the burnt trace of the resin which had hafted them into their shafts. A collection of half a dozen bulbous leaf-shaped arrowheads of rare shape, found together beside the northern entrance palisade, suggested the position of a quiver abandoned during the battle.

This violent episode effectively ended the long history of enclosure on Crickley Hill. One element, however, remained. The fills of the continuous ditch displayed a conventional asymmetrical cross section, such as that produced by natural collapse and silting. Towards the top, the rubble and frost-shattered infilling layers of earth and humus demonstrate a considerable period of slow burial. At this stage, the topmost levels of the ditch were interrupted by a narrow vertically cut trench, which contained charcoal powder and tiny fragments, and had clearly been burnt. This recut was perhaps connected with the use of the long mound.

It remains very difficult to say at what interval other construction resumed in the form of the long mound and its related structures (cf. Dixon 1988a, 86–7; Hollos 1999). We can certainly say that there were Iron Age post-built structures in what had been the interior of the Neolithic enclosures, and there is abundant Iron Age pottery. The model presented above strongly indicates that at least the south-east section of the long mound was completed in the fourth century cal BC (*405–285 cal BC*; *68% probability*; Fig. 9.11: *build SE long mound*). No samples were available from the central section, and at the north-west end only the samples from the platform and from the second floor of the stone circle could be dated. Both, unfortunately, can only be treated as *termini post quos*, and so we cannot say whether either these features or the north-west section of the long mound, which was stratified between them, are Neolithic in date or not. It would not be unusual in the least if an arrangement of stone circle and elongated, low, mound were to be Neolithic or Early Bronze Age in date, but it could also prove to be surprisingly late, and to have more implications for an Iron Age creation of a sacred past than for the last beat of Neolithic activity on the hill. We must simply wait until analysis of finds and structures has been completed before being in a position to make a more definitive statement.

So far Crickley Hill has been discussed on its own, but it is time to bring in Peak Camp. Is this a separate site, or part of a single complex, as has been argued for the different elements at Hambledon Hill (Chapter 4; Mercer 2004; Healy 2004; Mercer and Healy 2008)? Intervening earthworks were sought but not found during the investigations at Peak Camp. It may be pertinent that Crickley Hill and Peak Camp are separated by a steep-sided valley which could itself have been something of a boundary (Fig. 9.1), while the two Hambledon enclosures, while on opposite sides of a coombe, still occupy the same block of chalkland and are connected by a continuous ridge (Fig. 4.2).

The chronological model enables the construction of enclosures on the two spurs to be related in time (Fig. 9.20). The outer circuit at Peak Camp was built before the continuous ditch at Crickley (*96% probable*) and probably after the inner circuit of the causewayed enclosure at Crickley (*78% probable*). It was probably built in the interval between the completion of both circuits of the causewayed enclosure and the inception of the continuous circuit at Crickley (*74% probable*). It is also possible, however, that the causewayed enclosures at Crickley and Peak Camp were built by the same generation of people, living in the third quarter of the 37th century cal BC.

The dated earthworks of these two neighbouring enclosures were probably built within a generation of each other and were in concurrent use, at least until the destruction of Crickley in the mid-35th century cal BC (*3490–3450 cal BC*; *68% probability*; Fig. 9.20: *battle of Crickley*). People may have continued to frequent Peak Camp for rather longer, perhaps into the 33rd century cal BC (*3330–3215 cal BC*; *68% probability*; Fig. 9.19: *end*

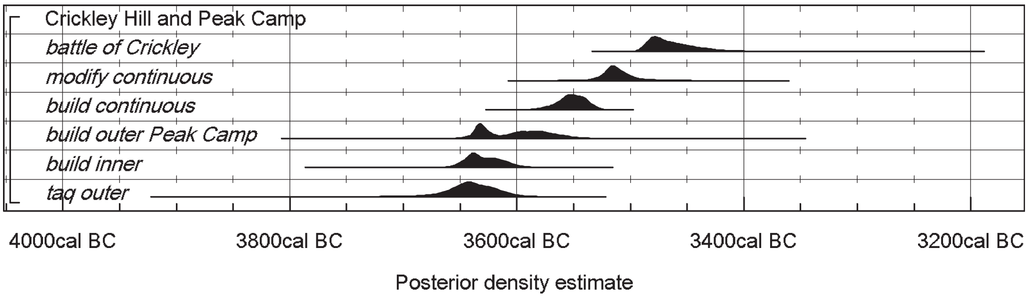


Fig. 9.20. Crickley Hill and Peak Camp. Posterior density estimates for the construction of Neolithic earthworks on the two spurs, derived from the models shown in Figs 9.7–10 and 9.19.

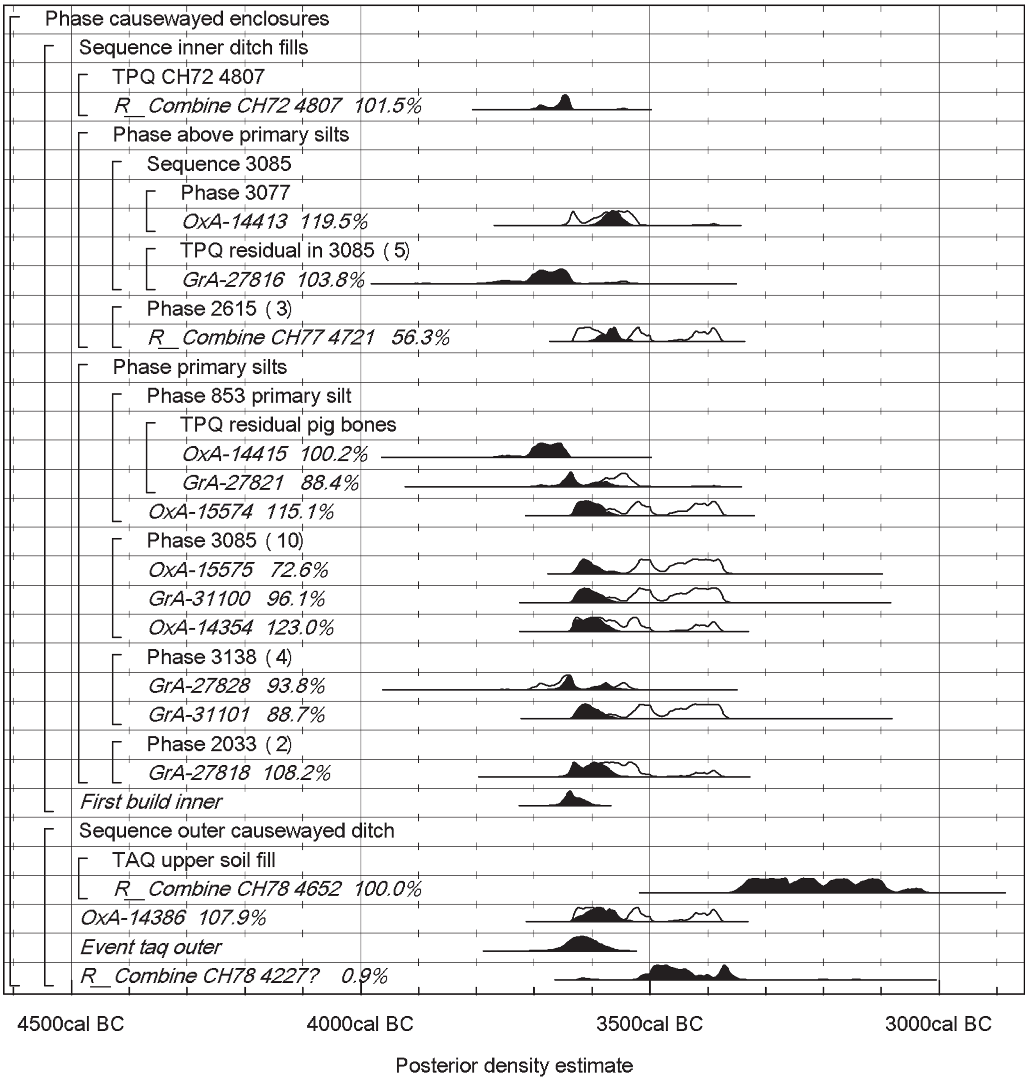


Fig. 9.21. Crickley Hill. Probability distributions of dates from the inner and outer circuits of the causewayed enclosure, according to the alternative model that does not include the inferred relative sequence between these circuits. The format is identical to that of Fig. 9.8. The overall structure of this model is shown in Figure 9.7, with the structures of the other component sections shown in Figs 9.8 and 9.10 (although the posterior density estimates shown on these figures are not those relating to this model).

Peak Camp), although this late date is entirely dependent on a single measurement (OxA-638).

Since the two enclosures are so close together and were in concurrent use, it is hard to conceive of their being entirely independent, but the relationship between them remains conjectural. Their proximity might speak for fluctuating and extremely poor relations between neighbouring communities, such that the builders of Peak Camp provocatively took over the very next spur within sight of the still new causewayed enclosure on Crickley

Table 9.4. Radiocarbon dates from West Tump, Burn Ground, Notgrove, Sale's Lot, Druid Stoke and Duntisbourne Grove. Identifications of the bone deposits from Burn Ground are by Martin Smith. Posterior density estimates derive from the models defined in Figs 9.22 and 9.24–7.

Laboratory Number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
West Tump, Gloucestershire							
Wk-17196	1913:33:2428	Human. Rib from almost completely articulated skeleton of 13–17 year-old (Brickley and Thomas 2004)	At back of lateral chamber, ' arranged around the end were five flat stones, on which was siting, in a contracted form, the skeleton of a young subject, with the remains, probably of a baby [in fact a puppy (Brickley and Thomas 2004)] in close proximity. This skeleton appeared to be quite undisturbed . . . but the femora were reversed, *i.e.*, the head of one femur, with part of the pelvis attached, was close to the skull (underneath it), whilst the head of the other femur was 15 inches from the skull; with this remarkable exception, the skeleton was in proper order and in a contracted form.' (Witts 1881, 207)	4897±38	−20.7±0.2	3770–3630	*3760–3630* (*91%*) or *3560–3535* (*4%*)
Wk-17195	1913:33:2428	Human. Disarticulated rib	In the lateral chamber, where 'rubble and bones in a very disorderly state' near the entrance gave way to semi-complete skeletons (Witts 1881, 206)	4656±41	−20.9±0.2	3630–3350	*3625–3600* (*5%*) or *3525–3360* (*90%*)
Wk-17198	1913:33:100. Skeleton 4	Human. Rib from articulated skeleton of adult	Inserted into SW side of cairn. 'At a point 56 feet from the southern horn, a few small bones were seen just outside the wall, which had evidently been disturbed. In moving the wall we discovered a skeleton (No. 4) in a contracted position, firmly wedged in among the stones — so firmly that many of the stones had to be broken.' (Witts 1881, 204)	4710±37	−20.2±0.2	3640–3370	*3635–3555* (*31%*) or *3540–3485* (*24%*) or *3470–3370* (*40%*)
Wk-17199	1913:33:2650. Skeleton 5	Human. Long bone shaft fragment from articulated skeleton of child	Inserted into SW side of cairn between skeletons 4 and 6 and within a foot (0.30 m) of skeleton 4, crouched (Witts 1881, 204–5)	4655±37	−20.4±0.2	3630–3350	*3625–3605* (*3%*) or *3525–3360* (*92%*)
Wk-17200	1913:33:242. Skeleton 6	Human. Rib fragment from articulated skeleton of adult	Inserted into SW side of cairn close to skeletons 4 and 5 (Witts 1881, 205)	4706±39	−20.7±0.2	3640–3360	*3635–3555* (*29%*) or *3540–3485* (*24%*) or *3475–3370* (*42%*)
Wk-17201	Skeleton 7	Human. Partly articulated skeleton of adult	Buried outside SW side of cairn, 'the skull and the feet were 48 inches apart, lying against the wall, and the space between them contained the skeleton, thus giving the idea at first that it was lying nearly at full length, but such was not the case. Next to the skull came the ossa coccyges, them twelve of the vertebrae in place, then the femora, tibias, &c.' (Witts 1881, 205)	4527±42	−21.2±0.2	3370–3090	
Burn Ground, Gloucestershire							
Wk-17169	A2611. BG001	Human. Disarticulated long bone shaft fragment from group of bones mainly from a single adult	SW transept (Grimes 1960; Smith and Brickley 2006, fig. 2: deposit 1; Cowley's (1960) iii)	4670±39	−21.5±0.2	3630–3360	*3635–3575* (*52%*) or *3530–3395* (*43%*)
Wk-17170	A2612. BG002	Human. Disarticulated ulna from small group of bones mainly from one adolescent	SE transept (Grimes 1960; Smith and Brickley 2006, fig. 2: deposit 2; Cowley's (1960) ii)	4833±37	−20.9±0.2	3700–3520	*3700–3620* (*63%*) or *3600–3525* (*32%*)

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Wk-17171	A2613. BG003	Human. Disarticulated long bone shaft fragment from small group of bones mainly from one adult	NE transept (Grimes 1960; Smith and Brickley 2006, fig. 2: deposit 3; Cowley's (1960) iv)	5035±34	−21.7±0.2	3960–3710	*3935–3710*
Wk-17172	A2614. BG004	Human. Disarticulated radius from small group of bones mainly from one young adult	N transept (Grimes 1960; Smith and Brickley 2006, fig. 2: deposit 4; Cowley's (1960) v)	5255±35	−21.4±0.2	4230–3970	
Wk-17173	A2615. BG005	Human. Disarticulated fibula from small group of bones mainly from one adult	NW transept (Grimes 1960; Smith and Brickley 2006, fig. 2: deposit 5; might equate to Cowley's (1960) vi)	5023±34	−21.6±0.2	3940–3770	*3935–3855 (26%)* or *3850–3705 (69%)*
Wk-17174	A2626. BG006	Human. Disarticulated long bone shaft fragment from small group of bones mainly from one ?female adult	N entrance to transverse chamber (Grimes 1960; Smith and Brickley 2006, fig. 2: deposit 6; Cowley's (1960) vii, 'animal bones')	5012±34	−21.0±0.2	3950–3700	*3935–3855 (21%)* or *3845–3830 (1%)* or *3825–3700 (73%)*
Wk-17175	A2617. BG007	Human. Disarticulated long bone shaft fragment from large deposit including remains from at least 6 adults and 2 subadults	Transverse chamber (Grimes 1960; Grimes 1960; Smith and Brickley 2006, fig. 2: deposit 7; Cowley's (1960) viii)	4975±33	−21.2±0.2	3910–3660	*3895–3880 (2%)* or *3805–3655 (93%)*
Wk-17176	A2617. BG008	Human. Disarticulated long bone shaft fragment from large deposit including remains from at least 6 adults and 2 subadults	From the same context as Wk−17175	4892±36	−20.6±0.2	3760–3630	*3765–3720 (6%)* or *3715–3635 (89%)*
Wk-17178	A2619. BG010	Human. Disarticulated long bone shaft fragment from small group of bones mainly from one adolescent	Chamber (Grimes 1960; Smith and Brickley 2006, fig. 2: deposit 9; Cowley's (1960) i)	5014±35	−20.9±0.2	3950–3700	*3935–3855 (22%)* or *3845–3700 (73%)*
Notgrove, Gloucestershire							
Wk-17179	705.9.6	Human. Unweathered adult metacarpal, selected from among 129 mainly unidentifiable small fragments, a minority gnawed and heavily weathered, the small identifiable fraction possibly from a single individual of 20–30	From cist in rotunda sealed by mound (Clifford 1936, 125–7, fig. 2 and pl. XXXII: fig. 2)	4816±43	−21.1±0.2	3700–3520	*3695–3675 (3%)* or *3670–3520 (92%)*

Laboratory Number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Wk-17181	705.9.13	Human. Child occipital fragment	One of a number of unweathered fragments from at least three individuals from 'top of dome' (Clifford 1936, pl. XLIII: sections A–A, C–C)	4607±43	−21.5±0.2	3520–3130	*3520–3320 (90%)* or *3220–3180 (3%)* or *3155–3130 (2%)*
Wk-17182	705.1.7	Human. Medial hand phalanx	Chamber A (Clifford 1936, pl. XLII)	4784±38	−21.1±0.2	3650–3380	*3610–3495 (66%)* or *3435–3375 (29%)*
Wk-17184	705.3.1	Human. Occipital fragment	Chamber C (Clifford 1936, pl. XLII)	4427±38	−21.3±0.2	3330–2910	*3350–3205 (74%)* or *3195–3150 (4%)* or *3130–3005 (17%)*
Wk-17185	705.8.7	Human. Skull fragment	Chamber D (Clifford 1936, pl. XLII)	4586±37	−21.5	3500–3120	*3500–3425 (29%)* or *3385–3305 (52%)* or *3240–3170 (9%)* or *3160–3120 (5%)*
Wk-17186	705.4.20	Cattle. Neonatal calf skull fragment	Passage (Clifford 1936, pl. XLII)	4623±41	−21.4±0.2	3520–3340	*3520–3335*
Sale's Lot, Gloucestershire							
Wk-17187	45	Human. Long bone shaft fragment, cremated	Posthole 5 (O'Neil 1966, fig. 2)	4716±38	−17.7±0.2	3640–3370	*3635–3555 (32%)* or *3540–3490 (20%)* or *3470–3370 (43%)*
Wk-17188	30	Human. Temporal fragment	Over posthole 4 (O'Neil 1966, fig. 2)	4589±40±0.2	−21.3±0.2	3500–3120	*3515–3420 (33%)* or *3385–3305 (43%)* or *3240–3115 (19%)*
Wk-17190	21	Human. Long bone shaft fragment	Grave 2 (O'Neil 1966, fig. 2)	4476±39	−21.6±0.2	3360–3010	*3355–3085 (93%)* or *3060–3035 (2%)*
Wk-17191		Human. Possibly, but not certainly, from Beaker burial	Body of mound (O'Neil 1966, 24)	3727±37	−23.0±0.2	2265–2020	
Wk-17192	43	Human. Long bone shaft fragment, cremated	West side of chamber (O'Neil 1966, fig. 2)	4958±40	−20.7±0.2	3910–3650	*3800–3645*
Wk-17193	43	Human. Long bone shaft fragment	West side of chamber (O'Neil 1966, fig. 2)	4799±39	−20.6±0.2	3660–3510	*3660–3515 (94%)* or *3400–3380 (1%)*
Druid Stoke, Bristol							
HAR-8083	241−24	Human. Adult 5th metatarsal	Unaccompanied by other bones, on surface of buried soil beneath rubble which was probably the remnant of a largely destroyed mound, close to, but not in, surviving megalithic chamber (G. Smith 1989)	4070±90	−21.4	2890–2450	
Duntisbourne Grove, Gloucestershire							
NZA-8671	R241151/15	Charred hazelnut shells	Pit 94, context 113. Initial fill of pit, comprising burnt clay silt with charcoal, burnt animal bone, fired clay, occasional charred cereal grains, struck flint inc. 2 leaf arrowhead fragments and 2 sherds from a plain collared vessel, apparently of Fengate Ware (Mudd *et al.* 1999, 19–22, 310–13, 316–18)	4761±57	−23.8	3660–3370	*3650–3490 (72%)* or *3465–3375 (23%)*
NZA-8672	R24151/16	Charred hazelnut shells	Pit 142, context 168. Secondary fill of pit, containing struck flint, charcoal, occasional charred cereal grains, Bowl pottery and burnt clay (Mudd *et al.* 1999, 20–2)	4717±60	−24.3	3640–3360	*3640–3480 (55%)* or *3475–3370 (40%)*

Hill. Alternatively, the immediate area might have had a significance for two communities of users such that they constructed ceremonial foci in sight of each other, each perhaps on the edge of its catchment. It is equally plausible to think of the two sites as linked, having complementary roles for the same community, though the use of both spurs could be explained in a number of different ways, such as budding off or expansion within one unitary design.

Such a view of linkage between the Crickley Hill and Peak Camp enclosures, based on their close spatial and chronological relationship, could be reinforced by their shared position on the Cotswold escarpment. Both look out over the Severn valley, including the likely lowest available crossing point of the river at Kingsholm, and beyond as well, across the valley to the Forest of Dean, May Hill (a source of quern material from the Neolithic onwards), and the Malvern Hills: even, in clear weather, as far as the Sugar Loaf and Hay Bluff in the Black Mountains of Powys. It would not be entirely fanciful to think of such visible landmarks as placemarks (*pace* Fleming 2005), since the Sugar Loaf is one of the most prominent local features of the Black Mountains, around which cluster chambered long cairns of a style long associated with forms prevalent in the Cotswolds (Cummings and Whittle 2004, 56–68). It is probable that at least some of the Black Mountains long cairns (Ty Isaf, Pipton and Penywyrlod, Talgarth) had been built by the 36th century cal BC (Chapter 11, Fig. 11.11). If people could see out over this range, then others could look across to the Cotswold edge – although without being able to pick out individual spurs along it – from the same range of distances: some 95 km in the case of the Sugar Loaf.

What the enclosures of Crickley Hill and Peak Camp do not have is the affordance of long views on to or down the dipslope of the Cotswolds. Looking east, there is little or no extended view. But there are of course numerous other Neolithic sites on the Cotswolds, from occupation sites to the well known chambered long barrows, and some other causewayed enclosures (Oswald *et al*. 2001, fig. 1.1; Saville 1990, fig.1; Darvill 2004a; 2006), and it is to this wider area that we now turn.

9.4 Implications for the region

The chronological models presented here for Crickley Hill and Peak Camp highlight how imprecise our general knowledge is of the Neolithic sequence in the Cotswolds, another of the supposedly well researched areas of southern Britain. Given the initiation of Crickley Hill in the mid-37th century cal BC, what else from the familiar Neolithic archaeology of the region can be related to this new chronological framework? The answer is that there is surprisingly little.

The Mesolithic finds from Crickley form part of an extensive spread of Mesolithic material, mainly characterised by geometric microliths, along the Cotswolds (Saville 1984, fig. 4; Holgate 1988a, map 9; Snashall 2002, 129–31; Darvill 2006, 16–18). Other locations shared with the sites of Neolithic monuments include Southmore Grove (evidenced by a fieldwalked collection: Saville 1985; Snashall 2002, 98–9), Hazleton (Saville 1990) and Ascott-under-Wychwood (Benson and Whittle 2007). At Hazleton, as at Crickley, there was an interval between the Mesolithic and the Neolithic presence, in this case indicated by the distinct distributions of Mesolithic and Neolithic artefacts in the pre-cairn soil (Saville 1990, figs 162–3). At Ascott-under-Wychwood, the radiocarbon dates suggest that there may have been little lapse of time between sporadic fifth millennium activity and the Neolithic occupation of the early fourth millennium cal BC (Bayliss *et al.* 2007c, figs 4–5).

Snashall (2002, 130–2) sees diverse levels of permanency in the earlier Neolithic lithic scatters of the region, some reflecting sustained presence and a wide range of activities, others greater transience and the execution of fewer tasks, and it is possible that relatively substantial fourth millennium scatters relate to long barrows (Darvill 2004a, 197–8). Low-level activity in the area of Crickley Hill and Peak Camp is reflected by the results of fieldwalking on the line of the 2.6 km Birdlip bypass less than 1 km to the east, where there were late Mesolithic and earlier Neolithic elements in a predominantly later collection (Darvill 1984b; Snashall 2002, 62–6). Some 6 km to the north-east, a possibly fourth millennium cal BC pit was found in a pipe trench at Charlton Kings, the simple pot represented in it being either Neolithic or Iron Age in date (Rawes 1991, 32, 74). Excavation in advance of another road scheme, the A419/A417 Swindon to Gloucester route at Birdlip Quarry, 3 km to the east, led to the discovery of a number of pits, only one of which contained finds, in the form of struck flint, indeterminate prehistoric sherds, charred hazelnut shell and charred cereals, and there was an early Neolithic component in the remaining struck flint from the site. On the same route, at Duntisbourne Grove, some 15 km south-east of Crickley Hill and Peak Camp, several shallow pits were clustered with an arc of five postholes. Charred hazelnut shell from two of the pits was dated to 3660–3370 cal BC (95% confidence; Table 9.4: NZA-8671) and 3640–3360 cal BC (95% confidence; Table 9.4: NZA-8672). The first pit contained Fengate Ware, for which the date seems rather early (Mudd *et al.* 1999, 21–2), although the rim is not typical of the Fengate substyle, and it is possible that the sherd is a Bowl rim with a deep thumb groove rather than a collar, or that the 'collar' base is really a coil break (Alistair Barclay, pers. comm.). The second pit contained Bowl pottery. The lithics from both were correspondingly predominantly early to middle Neolithic, and the fills were characterised by charcoal and burnt clay (Mudd *et al.* 1999, 17–25, 307–20; Snashall 2002, 124–5). The contents look like the residue of occupation, and the arc of postholes, animal bone, charred cereals and fragments of a quern confirm this impression. Small quantities of early Neolithic lithics were recovered elsewhere along the route, with single Bowl sherds at St Augustine's Lane, Preston, and Court Farm, Latton. If the route is representative of the terrain through which it passed, pit groups must, like early Neolithic artefacts, occur widely across the landscape,

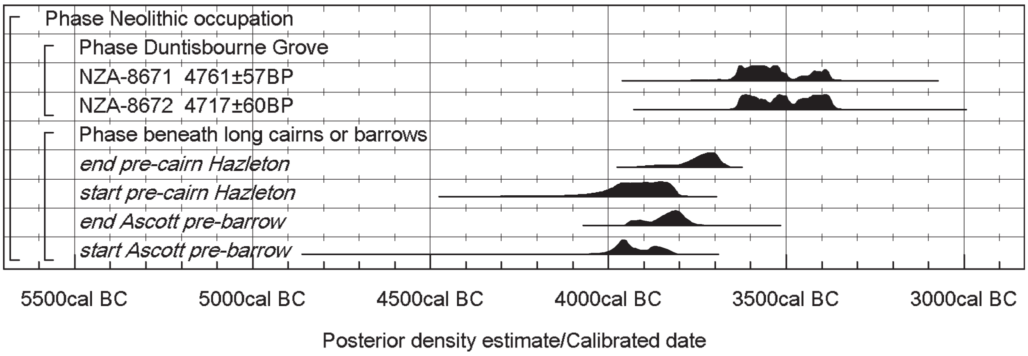


Fig. 9.22. Neolithic occupation in the Cotswolds. The measurements from Duntisbourne Grove have been calibrated (Stuiver and Reimer 1993). The distributions for the pre-cairn and pre-barrow occupations at Hazleton North and Ascott-under-Wychwood derive from the models defined by Meadows et al. *(2007, figs 6–9) and Bayliss* et al. *(2007c, figs 3–9) respectively. The format is identical to that of Fig. 9.8.*

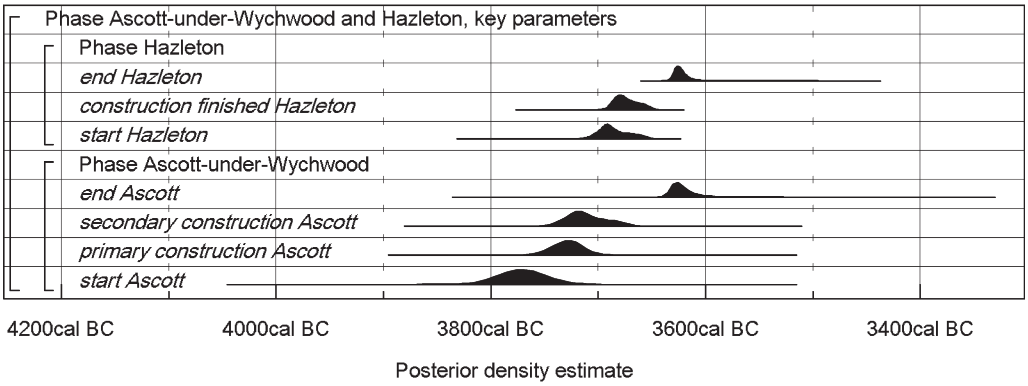


Fig. 9.23. The Hazleton North and Ascott-under-Wychwood long barrows. Posterior density estimates for key parameters, derived from the models defined by Meadows et al. *(2007, figs 6–9) and Bayliss* et al. *(2007c, figs 3–9) respectively.*

although few have so far been found in this area.

Otherwise, settlements are best preserved under long barrows and cairns. At Ascott-under-Wychwood, Neolithic occupation under the barrow also included two small post-built structures but goes back earlier than Duntisbourne Grove, to the 39th century cal BC, if not also the 40th century (*4015–3815 cal BC*; *95% probability*; Bayliss *et al*. 2007c, fig. 5: *start_occupation*=Fig. 9.22 here: *start Ascott pre-barrow*). The estimate for the pre-cairn Neolithic occupation at Hazleton, with a further wooden structure (Saville 1990, figs 13, 18), is less precise but is also probably of at least 39th century cal BC date (*4075–3800 cal BC*; *95% probability*; Meadows *et al*. 2007, fig. 7: *start of pre-cairn phase*=Fig. 9.22 here: *start pre-cairn Hazleton*). Another slight timber structure has been recognised retrospectively, partly exposed where some of the mound of Sale's Lot was removed, possibly in the Romano-British period (Darvill 1982b, 60–1; Hey and Barclay 2007; and see below).

The perennial question of whether the construction of monuments over these settlements was deliberate or coincidental is complicated by the probability that former settlement could well have provided the attraction of an already cleared or at least less densely wooded area (Saville 1990, 254). Intervals between Neolithic settlement and construction at Hazleton, where there was an intervening episode of cultivation (Macphail 1990), and at Ascott-under-Wychwood, where probably more than fifty years elapsed between the pre-barrow occupation and the construction of the barrow (*94% probable*; Bayliss *et al.* 2007c, fig. 9), would implicate memory of previous settlement episodes in any deliberate siting of barrows and cairns over settlements.

Although long barrows and cairns themselves are a salient feature of the period in the Cotswolds, few are well dated. The construction of the long barrow at Ascott-under-Wychwood belongs in the second half of the 38th century cal BC (Bayliss *et al*. 2007c, fig. 6: *primary construction*=Fig. 9.23 here: *primary construction Ascott*); and that of the long barrow at Hazleton belongs in the first half of the 37th century cal BC (Meadows *et al*. 2007, fig. 8: *construction finished*=Fig. 9.23 here: *construction finished Hazleton*). Active use of both monuments came to an end in the latter part of the 37th century cal BC (Fig. 9.23: *end Ascott* and *end Hazleton*). Isotopic dietary analysis of individuals from these two monuments (R. Hedges *et al*. 2007b; 2008) is discussed in Chapter 13.

A plain Bowl from the back of the southern outer passage at Ascott-under-Wychwood probably dates to or just before the third quarter of the 37th century cal BC (Bayliss *et al.* 2007c, fig. 7; Barclay and Case 2007). Its neutral profile and expanded rim contrast with the forms of the light-rimmed,

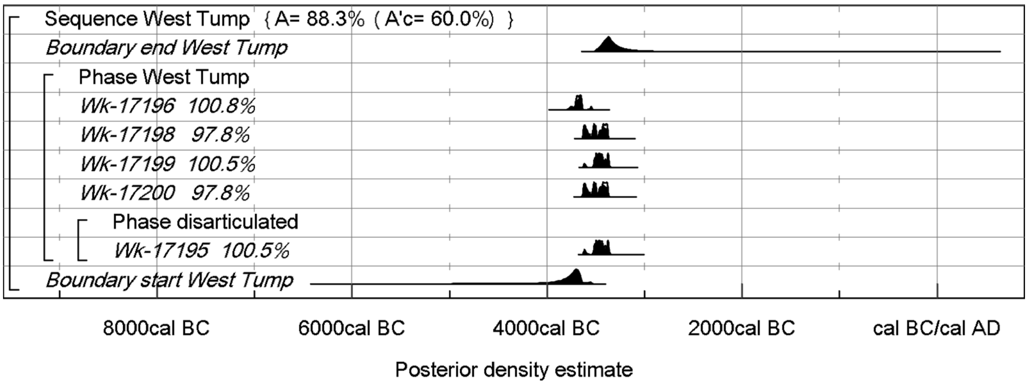


Fig. 9.24. West Tump. Probability distributions of radiocarbon dates. The format is the same as for Fig. 9.8. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

often carinated Bowls of the earlier, pre-barrow occupation (Barclay and Case 2007). Bowls from construction contexts and chambers, as distinct from pre-mound contexts, in other barrows and cairns in the region tend correspondingly to be unshouldered with fairly emphatic rims (Darvill 2004a, 119, 166–7, figs 51, 68, 69).

Recent work by Martin Smith and Megan Brickley (2004; 2006) has further elucidated the histories and burial practices of four more long barrows: a lateral-chambered mound at West Tump, on a spur of the escarpment 2 km south-west of Peak Camp, and three sites farther to the east, close to Hazleton and not far west of Ascott-under-Wychwood: a terminal- and lateral-chambered cairn at Burn Ground, a terminal-chambered cairn preceded by a rotunda at Notgrove, and a lateral-chambered cairn preceded by a rotunda and a simple passage grave at Sale's Lot. These studies were principally concerned with elucidating variation in burial practice, and samples for radiocarbon dating were selected to address this objective (Smith and Brickley 2006). Twenty-six samples of human bone were dated and a single calf skull (Table 9.4). They were prepared and graphitised at the University of Waikato Radiocarbon Dating Laboratory using methods described by Petchey and Higham (2000) and Slota *et al*. (1987), and measured by AMS at the Rafter Radiocarbon Laboratory using methods outlined in Zondervan *et al*. (2007).

Our knowledge of West Tump is heavily dependent on the account of the excavations by Rev. George Witts in 1880. This work focused on the facade, the south long side and immediately outside it, and the one known lateral chamber, entered from the south long side (Witts 1881). Radiocarbon determinations are available from the partially articulated remains of five individuals. One inhumation immediately beyond the limits of the south side of the cairn, and quite close to the lateral chamber entrance, was dated (two others were found in front of the façade). This person died in 3370–3090 cal BC (95% confidence; Table 9.4: Wk-17201). Four individuals (Smith and Brickley 2004) were inserted into the south long side of the cairn and so must post-date its construction; Witts observed disturbance of the walling at the locations of the burials (1881). Three of these were dated and produced statistically consistent radiocarbon measurements (Table 9.4: *Wk-17198–200*; T'=1.4; T'(5%)=6.0; ν=2). A minimum number of 14 people were recovered from the lateral chamber (Smith and Brickley 2004; 2006, 341). One individual, 'sitting, in a contracted form' (Witts 1881, 207) close to a puppy (Brickley and Thomas 2004), at the back of the lateral chamber produced a significantly earlier date (Table 9.4: *Wk-17196*; T'=24.0; T'(5%)=7.8; ν=3). A sixth radiocarbon determination (*Wk-17195*) was obtained from a disarticulated rib from farther forward in the chamber near the entrance, in a context of mixed rubble and bones. At first sight, it would be reasonable to suppose that the complete individual at the back of the lateral chamber was a primary deposit inserted immediately after construction of the monument. Strictly, however, we have no direct stratigraphic relationships between this and the disarticulated remains farther forward in the chamber or between this and the inhumations inserted into the revetment. On this basis, all the dated remains are treated as belonging to a single phase of activity. Little weathering was observed on any of the remains, and small hand and foot bones were well represented (Smith and Brickley 2004, 20, and pers. comm.), which further supports the interpretation of the deposition of these individuals soon after their deaths.

A chronological model for West Tump is shown in Fig. 9.24. Based on this preliminary sample, our estimates are imprecise but suggest that the monument was constructed in *4135–3540 cal BC* (*95% probability*; Fig. 9.24: *start West Tump*), probably in *3820–3645 cal BC* (*68% probability*). Deposition within the cairn ended in *3515–2910 cal BC* (*95% probability*; Fig. 9.24: *end West Tump*), probably in *3455–3265 cal BC* (*68% probability*). These estimates do little more than place West Tump within the span already established for Cotswold long barrows (Darvill 2004a; Whittle *et al*. 2007a), and raise the possibility that the individuals buried in this cairn could have been among the builders and users of the local causewayed enclosures at Peak Camp and Crickley Hill, from the first of which it is separated by a walk of only some 45 minutes. Further dating of more individuals from this monument is highly desirable.

Burn Ground, Hampnett, lies a little to the south-east of Hazleton. Its plan is unusual, since transepted chambers

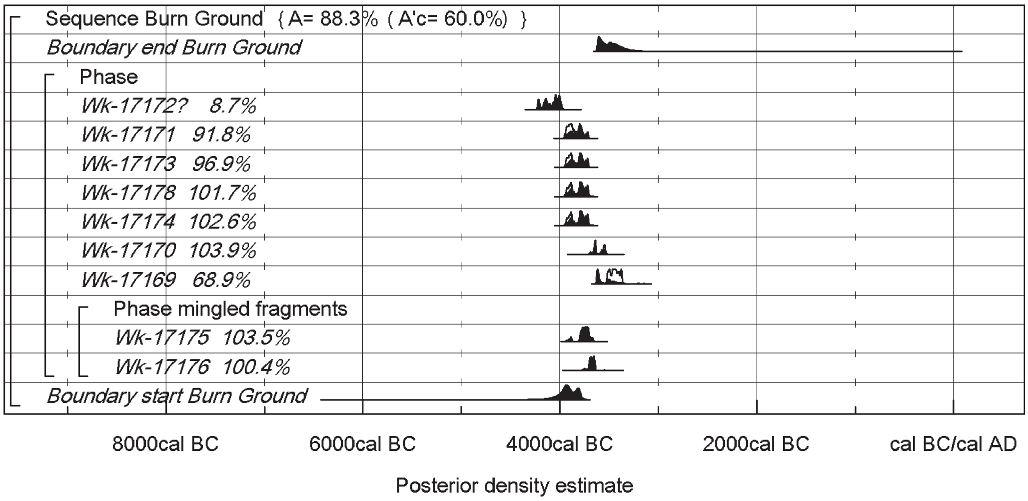


Fig. 9.25. Burn Ground. Probability distributions of radiocarbon dates. The format is the same as for Fig. 9.8. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

at the east end of the slightly trapezoidal long cairn are linked by a continuing passage to a complete transverse corridor (Grimes 1960, fig. 15). Nine separate deposits of human bone were found, principally in the chambers and transverse corridor (Grimes 1960; Cowley 1960), and appear on re-examination to consist of the remains of a minimum of ten adults and three sub-adults, with no signs of weathering or scavenging (Smith and Brickley 2006, 337–9, and pers. comm.). Eight of the discrete bone deposits seem to consist mainly, although not entirely, of bones from a single individual (Smith and Brickley 2006, 339). Samples were dated from each of these bone deposits, who are interpreted by us to have been placed within the monument soon after their deaths (though one of these, Deposit 8, from the body of the cairn, turned out to be an intrusive burial of Romano-British date: Martin Smith, pers. comm.). A further two samples were dated from a large, mixed deposit in the transverse corridor (Smith and Brickley 2006, fig. 2, no. 7) which contained the remains of at least eight individuals. We have no evidence as to whether these individuals were placed fleshed in the monument, although their dates are compatible with the others just described, and we interpret the remains at Burn Ground as a whole as neither ancestral nor curated.

A chronological model for Burn Ground is shown in Fig. 9.25. We have excluded Wk-17172 from the analysis. This is a significantly early outlier and is earlier than any of the reliable measurements we have so far considered from the Cotswolds. This sample came from bone group 4, in one of the transepted chambers, and probably came from the one young adult whose bones constituted the majority of this group (‘a good many human bones’: Cowley 1960, 71). On re-examination there were in fact only 24 bone fragments in this group, although whether any had been lost since excavation is unknown; only one clavicle definitely derives from a second individual (Martin Smith and Megan Brickley, pers. comm.). We believe therefore that this sample probably post-dates the construction of the monument, and the accuracy of the existing measurement needs to be confirmed. On the other hand, the $\delta^{13}C$ value (−21.4±0.2‰) for this measurement is within the expected range, and so this result may be accurate. If so, either Burn Ground is the earliest example of Neolithic architecture in the Cotswolds, or Smith and Brickley’s suggestion (2006, 348) that the remains in question were curated is plausible. It is highly desirable that a replicate measurement be obtained on this sample in due course.

All the other dates in this model are interpreted as the remains of individuals who died shortly before deposition in the monument. On this basis, we estimate that Burn Ground was constructed in *4140–3760 cal BC* (*95% probability*; Fig. 9.25: *start Burn Ground*), probably in *3985–3875 cal BC* (*46% probability*) or *3860–3790 cal BC* (*22% probability*). Deposition in the monument ended in *3630–3255 cal BC* (*95% probability*; Fig. 9.25: *end Burn Ground*), probably in *3620–3525 cal BC* (*38% probability*) or *3520–3420 cal BC* (*30% probability*). Again, these estimates are relatively imprecise and further dating is desirable. However, it appears probable that the initial construction at Burn Ground is earlier than both those at Ascott-under-Wychwood and at Hazleton (Bayliss *et al*. 2007c; Meadows *et al*. 2007).

Notgrove, a little to the north-east of Hazleton, was excavated in 1934–5 (Clifford 1936; see also Witts 1881). It consists of a trapezoidal long cairn which contains transepted chambers at its east end, and within the main body of the cairn behind these, the truncated remains of a small, well built, circular stone structure, with central cist, originally called the ‘central dome’ (Clifford 1936, 125). This has later come to be known as a rotunda (Darvill 2004a). The rotunda contained the remains of an adult, thought to have been placed in a sitting position (Clifford 1936, 126; it is not now possible reliably to sex the remains, which were originally identified as male: Martin Smith, pers. comm.). Elsie Clifford interpreted the rotunda as ‘the first structure built’, since its construction could hardly have been possible had the orthostat of the back wall of the end transepted chamber been in place (1936, 125), but does not otherwise comment on this aspect of constructional sequence. The

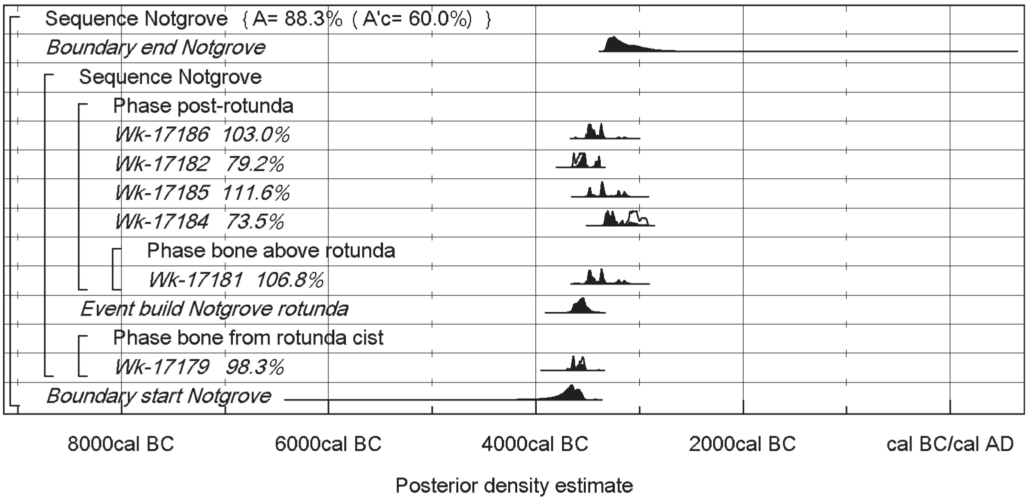


Fig. 9.26. Notgrove. Probability distributions of radiocarbon dates. The format is the same as for Fig. 9.8. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

rotunda was later taken to be an independent, free-standing construction (Darvill 1982b; 2004a). A number of largely fragmented human remains were recovered by Clifford from contexts other than the rotunda (1936, 142), now estimated – it being difficult to identify the majority even to skeletal element – as representing a minimum of nine further people (Smith and Brickley 2006, 344).

A chronological model for Notgrove is shown in Fig. 9.26. A radiocarbon date was obtained from bone from the cist in the rotunda (*Wk-17179*). This is presumably earlier than unweathered bone from one of at least three individuals, recorded by Clifford (and her bone specialist Arthur Cave) as from the 'the top of the central dome' (1936, 143, 150; Smith and Brickley 2006, 344). It should be noted that the top of the rotunda was truncated (Clifford 1936, 126, pl. XLIII) and that the exact position of these bones is not recorded. This was dated by *Wk-17181*. Since 'it would have been impossible to build the dry wall' of the rotunda if orthostat 16 of Chamber E had been standing, *Wk-17179* also probably pre-dates the four samples dated from the transepted chambers (*Wk-17182*, and *-17184–6*). This reading of the stratigraphic sequence is in good agreement with the radiocarbon determinations ($A_{overall}$= 88.3%). It does, however, depend on several archaeological assumptions which may be of varying reliability. The rotunda has no entrance. If access to it, once built, was not possible, then *Wk-17179* must be earlier than its construction, though if access were possible (for example, through dismantling the covering) until a later and final closure, this interpretation need not stand. We have interpreted these remains as neither ancestral nor curated. The unweathered bone from the top of the rotunda could be cited in support of this, but the fragmented condition of the assemblage as a whole should be remembered.

This model suggests that the monument sequence at Notgrove began in *3980–3525 cal BC* (*95% probability*; Fig. 9.26: *start Notgrove*), probably in *3730–3555 cal BC* (*68% probability*). The rotunda was constructed in *3660–3455 cal BC* (*95% probability*; Fig. 9.26: *build Notgrove rotunda*), probably in *3625–3525 cal BC* (*68% probability*). Burial ended in *3340–2785 cal BC* (*95% probability*; Fig. 9.26: *end Notgrove*), probably in *3320–3095 cal BC* (*65% probability*) or *3090–3065 cal BC* (*3% probability*). Although more dates could profitably be obtained from this assemblage, this model implies that Notgrove – including its rotunda – falls later rather than earlier in the sequence of Cotswold long cairns.

Sale's Lot, a little to the south-west of Hazleton, is another unusual monument. Helen O'Neil carried out extensive excavations in 1963–5, after damage by bulldozing, which rendered aspects of the sequence unclear. Besides a lateral chamber on the north long side of the cairn, two other structures were revealed. At the west end, close to the lateral chamber, a small chamber with drystone walling was set within indications of further circular walling within the body of the cairn. O'Neil simply labels this 'Grave 2' but this was later classed as a rotunda by Darvill (1982b; 2004a, 61). At the east end, there was a larger circular structure, with (as far as could be discerned despite quite extensive damage) forecourt, antechamber and chamber, and double walls. The excavator explicitly noted (H. O'Neil 1966, 16) that the material of the long cairn was 'piled up against' the outer circular wall and that 'this must have followed closely after the erection of the Ring wall as no weathering of the wall was apparent'. She called this circular structure a rotunda, though this has later been seen as a probable simple passage grave, and 'multi-period' construction involving the joining of two free-standing structures by a long cairn has been mooted (Darvill and Grinsell 1989, 52; Darvill 2004a, 57, 249). A very few human remains were recovered from the rotunda (*sensu* Darvill) and the lateral chamber, and scattered, probably residual, fragments of human bone came from elsewhere, including the larger circular structure (H. O'Neil 1966, 33; Smith and Brickley 2006, fig. 6).

A chronological model for Sale's Lot is shown in Fig. 9.27. Six samples of human bone have been dated (Table 9.4). One of these (Wk-17191) is probably from a Beaker

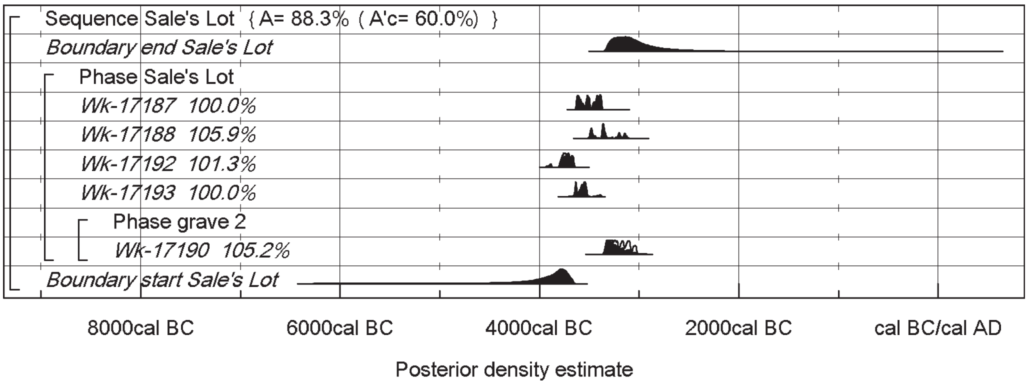


Fig. 9.27. Sale's Lot. Probability distributions of radiocarbon dates. The format is the same as for Fig. 9.8. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

burial inserted into the cairn and is not discussed further here. Two samples have been dated from the west side of the chamber of the larger circular structure, providing statistically inconsistent measurements (*Wk-17192–3*; T'=8.1; T'(5%)=3.8; ν=1). Two samples associated with postholes in the disturbed forecourt area were also dated (*Wk-17187–8*). The taphonomy of these two samples is unclear, as are the relationships of their dates to the posthole structure. Finally, a single determination was made from a fragment of bone from 'Grave 2', the small rotunda (*Wk-17190*). It is not possible to disentangle the stratigraphic relationships between these samples and so we have included the five relevant dates in a single phase of activity. This model suggests that deposition started at this monument in *4605–3650 cal BC* (*95% probability*; Fig. 9.27: *start Sale's Lot*), probably in *3975–3675 cal BC* (*68% probability*). Deposition in the monument ended in *3350–2315 cal BC* (*95% probability*; Fig. 9.27: *end Sale's Lot*), probably in *3310–2950 cal BC* (*68% probability*). These very imprecise estimates simply confirm that Sale's Lot was in use in the fourth millennium cal BC. They also imply that the small rotunda (containing 'Grave 2') was not the earliest element of the monument.

At Druid Stoke, near Bristol, a disarticulated human metatarsal dated to 2890–2450 cal BC (Table 9.4: HAR-8083) came from beneath rubble which may have been displaced from a much levelled mound (G. Smith 1989). The relationship of this sample to the mound is unknown.

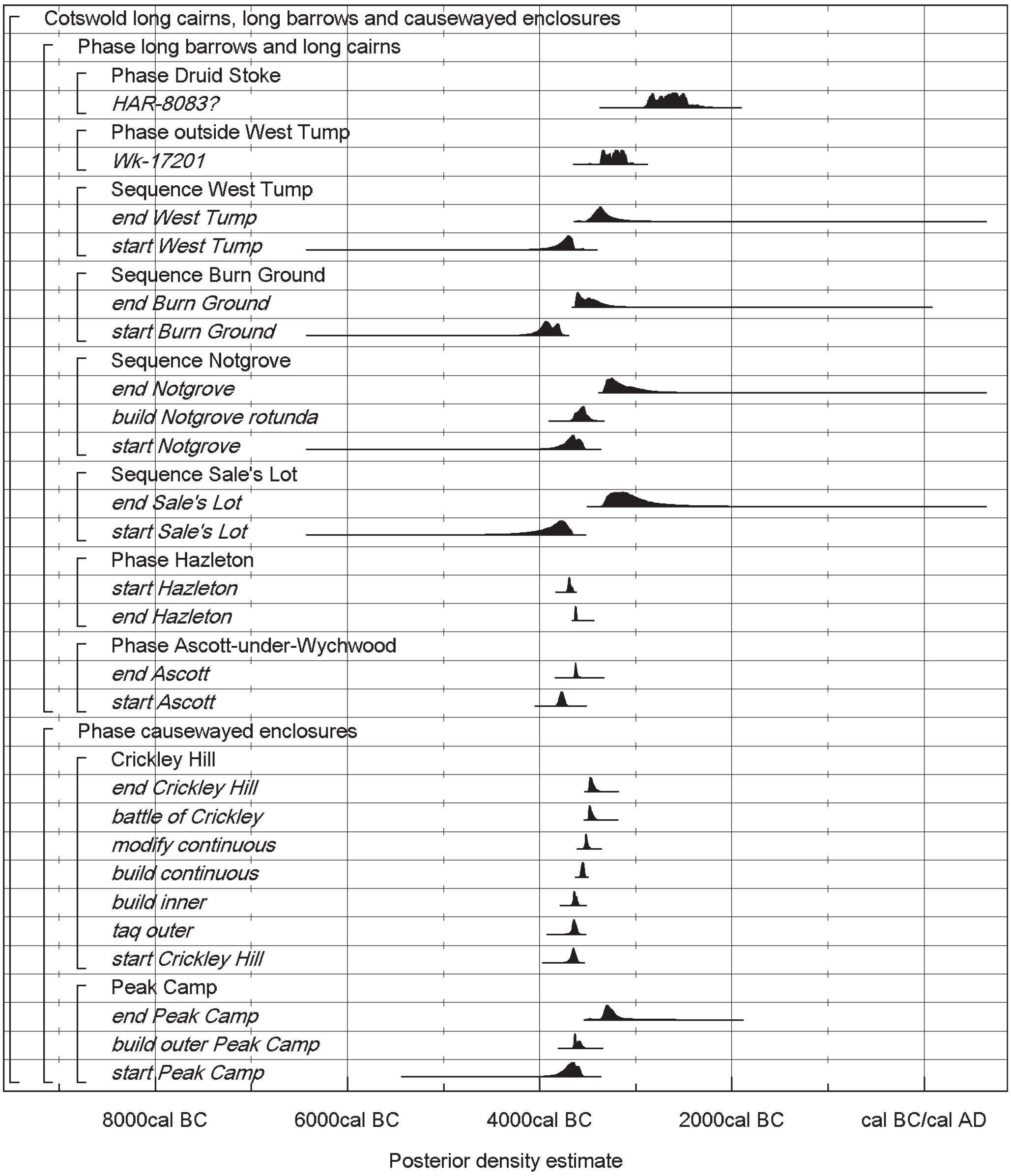
Finally, Belas Knap long cairn, Sudeley (some 13 km north-east of Crickley Hill), has lateral chambers and a distal chamber (Berry 1929; 1930, Hemp 1929). Five radiocarbon dates from human remains were obtained by Rick Schulting and have been published in preliminary form by Darvill (2004a, 256). Unfortunately, these measurements were affected by a chemical contamination problem at the Oxford Radiocarbon Accelerator Unit (Bronk Ramsey *et al.* 2004a; Bayliss *et al.* 2007a, fig. 25). These measurements have been withdrawn and replicate determinations are awaited.

A summary of the available chronology for Cotswold long cairns and barrows is shown in Fig. 9.28. On one level, this simply demonstrates that such monuments date to the fourth millennium cal BC. Construction, however, appears to be confined to the first half of the millennium, perhaps to a fairly narrow period between *c.* 3800 and *c.* 3600 cal BC. The duration of their use is uncertain. For the well dated sites – so far, Hazleton North and Ascott-under-Wychwood – this seems to be restricted to a few generations, or a couple of lifespans. These two sites, it can be noted, come from a small area, and are both of similar form, with lateral chambers; neither the dates nor the durations of other monuments within the Cotswold series as a whole need be identical. For sites with fewer dates, it is difficult to distinguish between a lengthy duration for the archaeological activity and the statistical scatter of the dates themselves.

On the basis of existing evidence, it is extremely probable that the earliest long cairn or barrow in the Cotswolds predates the first causewayed enclosure, the construction of both Ascott-under-Wychwood (*99% probable*) and Hazleton (*83% probable*) occurring before the construction of both Crickley Hill and Peak Camp, the enclosures so far dated in this region. Given the uncertainties of the existing dating for the other long cairns in the region, it is difficult to relate them to the relatively precise chronologies for the enclosures and for Ascott-under-Wychwood and Hazleton. Burn Ground at least appears to be earlier than the enclosures, and possibly also than Ascott-under-Wychwood and Hazleton too. The initial constructions at Notgrove and West Tump probably fall within the span of the histories of the enclosures and of Ascott-under-Wychwood and Hazleton; their dating is currently insufficiently precise, however, for us to determine their place within this sequence.

As things stand, our knowledge of the earliest Neolithic in the region is largely dependent on the evidence from long cairns and barrows. Occupations surviving under two long barrows – Hazleton and Ascott-under-Wychwood – are a principal element. Other relevant evidence may already exist in the archive, for example the pre-monument timber structure at Sales's Lot, noted above, and possibly at Nympsfield (Darvill 2004a, 93; Clifford 1938; Saville 1979), but the full potential of this for dating has not yet been realised in this region, including further material from Hazleton itself (Meadows *et al*. 2007).

The overall structure for a chronological model for the early Neolithic in the Cotswolds is shown in Fig. 9.29. The



9.28. Cotswold long barrows and causewayed enclosures. Posterior density estimates for key parameters are derived from the models defined in Figs 9.7–10, 9.19, and 9.24–7, and by Meadows et al. *(2007, figs 6–9) and Bayliss* et al. *(2007c, figs 3–9). The measurement from Druid Stoke has been calibrated (Stuiver and Reimer 1993).*

structures of the components of this model are shown in Fig. 9.30, Bayliss *et al.* (2007c, figs 5–7), and Meadows *et al*. (2007, figs 7–8) (although only the posterior density estimates in Fig. 9.30 are those relating to this model). The form of this model requires particular explanation beyond that already given in Chapter 2.4 and by Bayliss *et al.* (2007a). In order to prevent the numbers of radiocarbon dates from the burial chambers and cists at Hazleton and Ascott-under-Wychwood undesirably biasing the sample of dated events in this period, the phase boundaries from the models for these sites have been included as the active components in the model for the early Neolithic of the Cotswolds presented here (i.e. both Hazleton and Ascott-under-Wychwood are represented by four standardised likelihoods – the starts and ends of the pre-monument occupations and the starts and ends of the burial monuments). For the other sites, phase boundaries have not been included, but rather the calibrated radiocarbon dates provide the standardised likelihoods for the model. This approach is an attempt to ensure that the parts of the early Neolithic in the Cotswolds which have been preferentially sampled do not overly influence our model.

This model suggests that the first Neolithic presence in the Cotswolds dates to *4035–3845 cal BC* (*95% probability*; Fig. 9.29: *start Cotswold Neolithic*), probably in *3985–3890 cal BC* (*68% probability*). The end of this phase of early Neolithic activity occurred in *3330–3160 cal BC* (*95% probability*; Fig. 9.29: *end Cotswold Neolithic*), probably in *3315–3235 cal BC* (*68% probability*). When considering the earliest Neolithic in this region, it is important to note that there are indications of initial activity beyond the pre-monument occupations at Hazleton and Ascott-under-

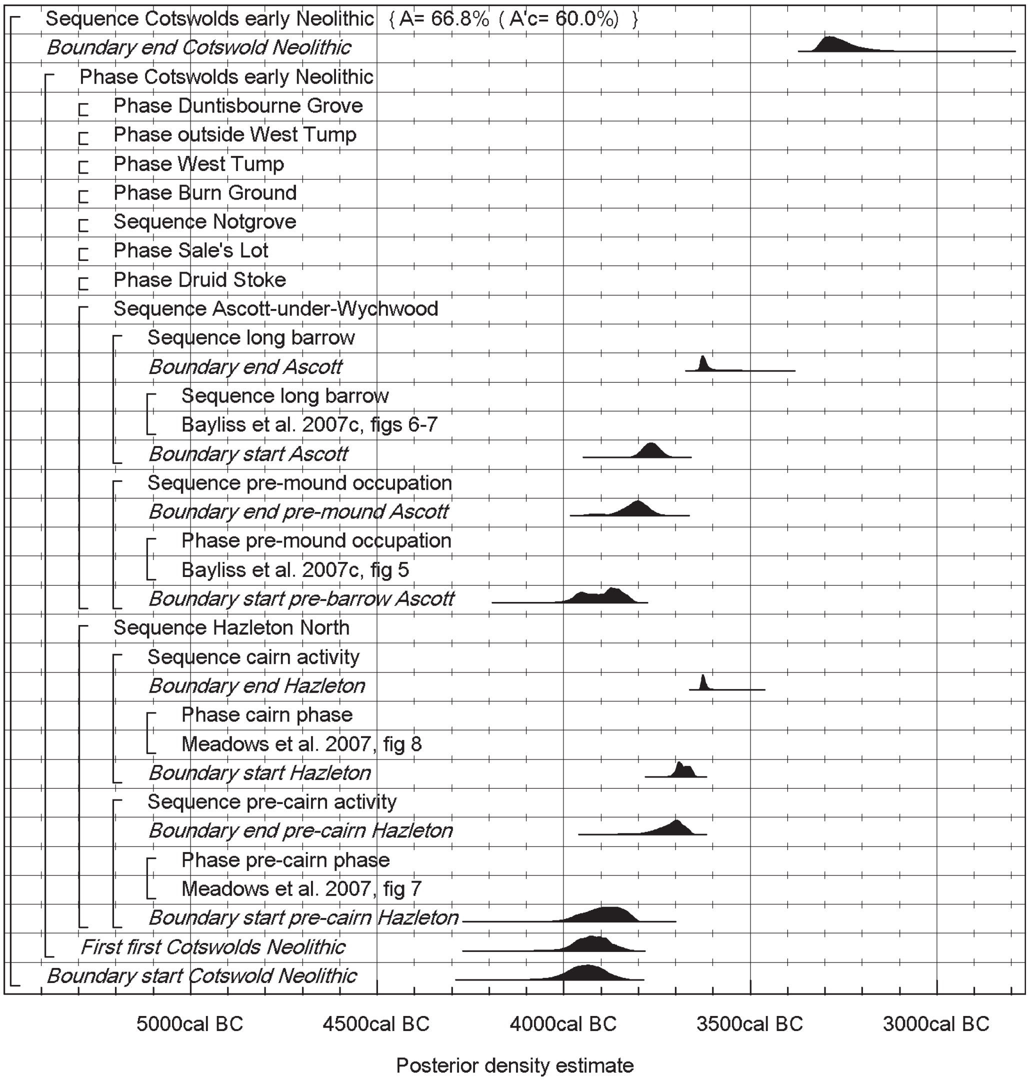


Fig. 9.29. The Cotswolds. Overall structure of the chronological model for the early Neolithic. The structures of the component sections of this model are shown in detail in Fig. 9.30, Meadows et al. *(2007, figs 7–8) and Bayliss* et al. *(2007c, figs 5–7) (although only the posterior density estimates shown on Fig. 9.30 are those relating to this model). The large square brackets down the left-hand side of these figures, along with the OxCal keywords, define the overall model exactly.*

Wychwood. Burn Ground in particular may be relevant, especially if Wk-17172 reliably indicates an exceptionally early date. The banana barrow at Crickley Hill is also relevant here, if interpreted as a Neolithic construction.

A summary chronology for the causewayed enclosures of the Cotswolds is shown in the model given in Fig. 9.31. This suggests that the start of enclosure construction in the Cotswolds fell in *3810–3625 cal BC* (*95% probability*; Fig. 9.31: *start Cotswolds enclosures*), probably in *3715–3640 cal BC* (*68% probability*). If we consider simply the first enclosure in this region to have been dated, our estimate becomes *3715–3620 cal BC* (*95% probability*; Fig. 9.31: *first Cotswold enclosure*), probably in *3675–3630 cal BC* (*68% probability*). Although one estimate encompasses the other, the difference between them illustrates the difficulty of modelling the chronology of the phenomenon as a whole on the basis of two sites (see Chapter 2.4.1). The model shown in Fig. 9.31 also suggests that Cotswold enclosures went out of use in *3480–3180 cal BC* (*95% probability*; Fig. 9.31: *end Cotswolds enclosures*), probably in *3475–3385 cal BC* (*59% probability*) or *3310–3270 cal BC* (*9% probability*).

Figure 9.32 shows our estimates for the start of the Neolithic in the Cotswolds and for the construction of the first enclosure. By taking the difference between *start Cotswold Neolithic* and *start Cotswolds enclosures,* we can estimate that enclosure construction began *95–385 years* (*95% probability*; Fig. 9.33: *initial Neolithic*), probably *190–320 years* (*68% probability*) after the first Neolithic presence in the Cotswolds – a dozen generations or so. We will return to the wider geographical significance of these estimates in Chapter 14, and to their implications in Chapter 15.

Common to all aspects of fourth millennium activity is the use of flint, most of which must have been brought from sources beyond the Cotswolds, much of it from the Chalk,

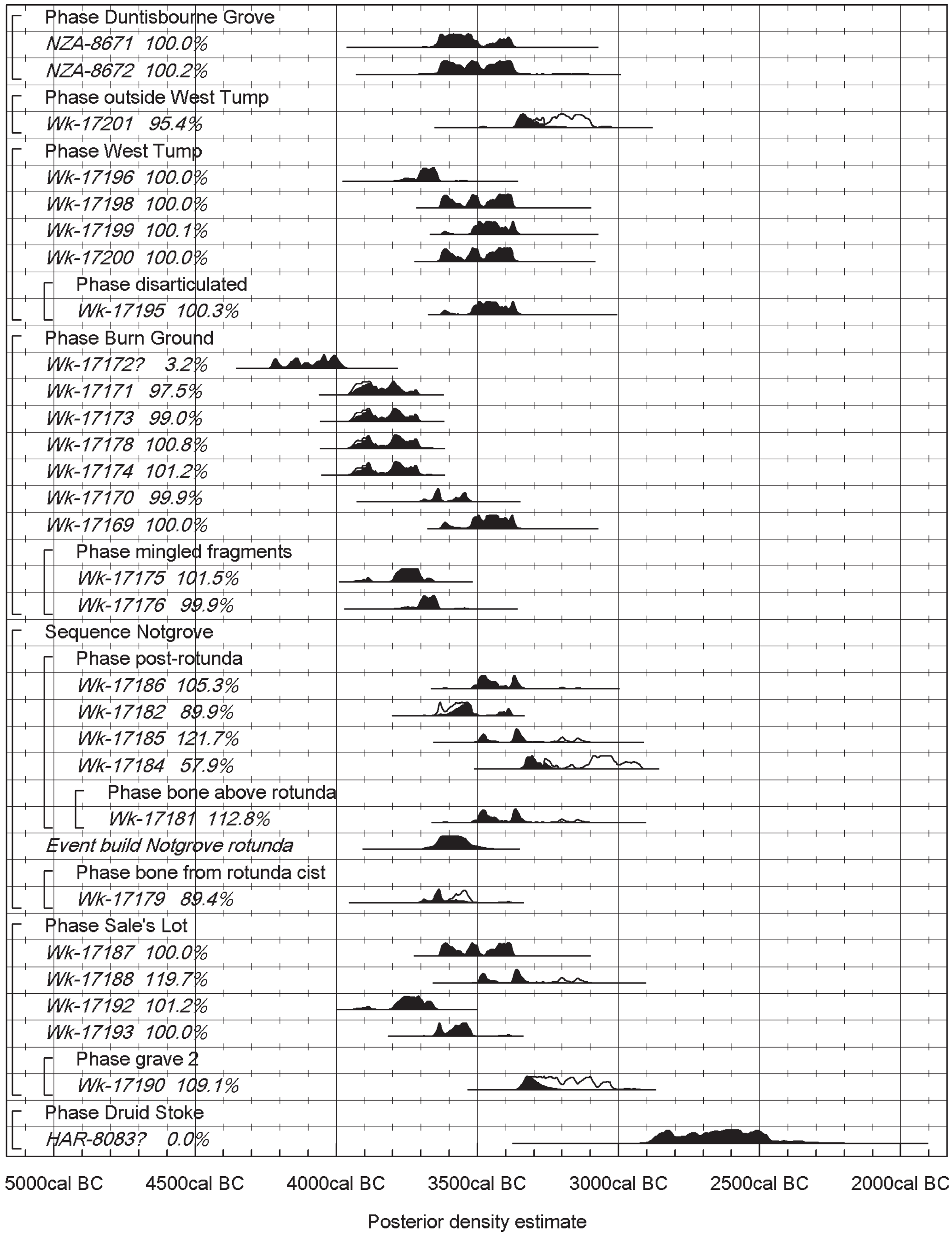


Fig. 9.30. The Cotswolds. Early Neolithic activity. Probability distributions of dates (except for Ascott-under-Wychwood, Hazleton North, Peak Camp, and Crickley Hill). The format is identical to that of Fig. 9.8. The overall structure of this model is given in Fig. 9.29, with the structures of its other components shown in Meadows et al. *(2007, figs 7–8) and Bayliss* et al. *(2007c, figs 5–7) (although the posterior density estimates in these figures are not those relating to this model).*

at an estimated level of 1175 kg or 1000 large nodules a year (Saville 1982). Flint was also brought from derived sources and such material was indeed in the majority at Peak Camp (Snashall 2002, 56). Mean core weights at both Crickley and Peak Camp are at the high end of the range for the northern Cotswolds, suggesting that flint may have been more freely available, and less parsimoniously worked, at the enclosures than in the surrounding area. Low proportions of primary flakes at both sites indicate that raw material was brought there in an already prepared state (Snashall 2002, 55–58). Snashall sees causewayed enclosures close to the escarpment as places where roughly prepared raw materials were brought and a wide range of implements manufactured (2002, 100). Also imported were finished axeheads, of both flint and stone, flint making up the majority in the region, and western or ungrouped sources accounting for most of the stone forms, although group VI implements are also well represented (Darvill 1984a, fig. 6; Darvill 1989). Despite the local predominance of flint axeheads (three-quarters of the total for Gloucestershire;

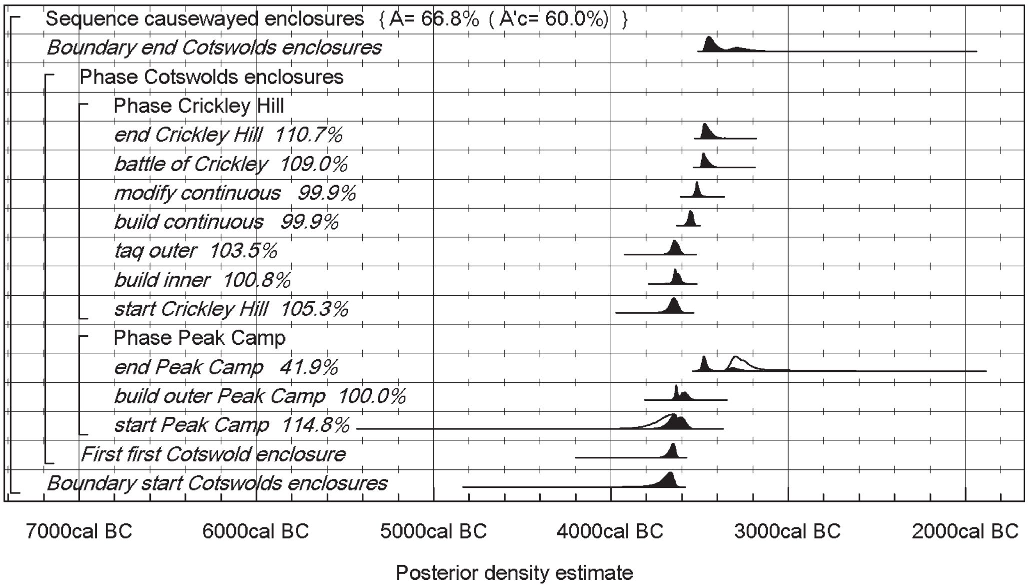


Fig. 9.31. The Cotswolds. Probability distributions of dates from causewayed enclosures. The model estimates the period during which the circuits were constructed and used. The likelihoods are taken from the posterior density estimates of key parameters derived from the models defined in Figs 9.7–10 and 9.19. The format is the same as for Fig. 9.8. The large square brackets down the left-hand side of these figures, along with the OxCal keywords, define the overall model exactly.

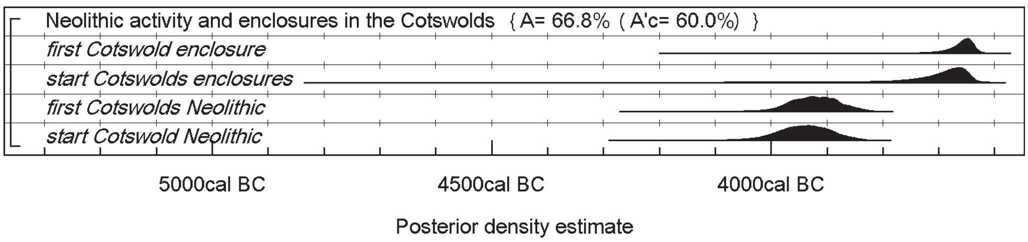


Fig. 9.32. The Cotswolds. Posterior density estimates for the start of the Neolithic and for the first enclosure in this region, derived from the models defined in Figs 9.29–30 and 9.31.

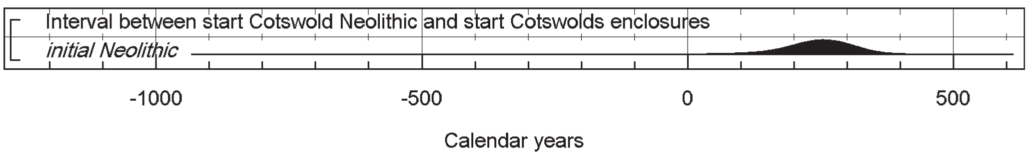


Fig. 9.33. The Cotswolds. Probability distribution of the number of years between the start of the Neolithic and the start of enclosures, derived from the models shown in Figs 9.29–30 and 9.31.

Darvill 1989, table 1), preliminary indications are that stone forms (none yet identified petrologically) are in the majority at Crickley Hill itself (20 out of 26). Here, axeheads of all materials tend to be fragmented and reworked (Snashall 1998, 44–51). The predominance of stone, like the relatively large size of flint cores, suggests that non-local materials may have been received preferentially at enclosures.

Where the inclusions in Bowl fabrics from the Cotswolds have been analysed, they are overwhelmingly local (Smith and Darvill 1990, 151; Darvill 2004b, fig. 2; Barclay and Case 2007). Conversely, pottery from Jurassic sources forms up to a third of Bowl assemblages in Wessex (Cleal 1995b), especially those dating from the mid- rather than early fourth millennium (Healy 2006, 19–20). Could this mean that pottery from the Cotswolds, as well as from the Jurassic ridge farther to the south-west, was brought to Wessex, just as flint was brought to the Cotswolds, and that enclosures played a role in these exchanges?

This summary shows how much remains to be established. Clearly, among the aspects presently unknown is whether other enclosures in the Cotswolds and the uppermost catchment of the Thames were as early as Crickley Hill and other enclosures of the 37th century cal BC. The density of probable sites in the east of the Cotswolds and upper Thames catchment is striking, and might speak for the kinds of history discussed in Chapter 4

for south Wessex and in Chapter 8 for the Thames valley, especially for its upper part, but at this stage of research on the Cotswolds this is speculation.

We can therefore hardly discuss the extent of possible areas served by particular enclosures in the same way as was tentatively possible in Chapter 4, but two points are worth making. When discussing views and visibility above, we suggested a strong contrast between the wide-ranging views to west and north and the much more limited prospect to the south and east, into the Cotswolds themselves. That need not mean a lack of contact with the upper Thames or Wessex, as discussion of pottery and lithics above has already suggested. It is likely therefore that the complex socialities seen at enclosures will have operated at several scales and in several spheres, precluding any simple reflection of territorial patterns on the ground.

Finally, we are still far from understanding the late history of Crickley Hill and Peak Camp. Our main model suggests the destruction of Crickley Hill in the 35th century cal BC, with some continuation of activity at Peak Camp, perhaps into the 33rd century cal BC. This is a time when cursus monuments were probably being built and used elsewhere, as we have discussed extensively in Chapters 4, 6 and 8 (and see Chapter 14). Before this dating programme, it would have been attractive to assign the long mound at Crickley Hill to this sort of period, but our results now suggest otherwise, as discussed above. A succession from circular to linear monuments may have occurred here at a regional rather than an immediately local level. The upper reaches of the Thames catchment saw the construction of numerous cursus monuments (Chapter 8; A. Barclay *et al.* 2003, chapter 10), and it may be that the ceremonial focus shifted at this time from the Cotswold slopes to the already monumentalised valleys.

10 The south-west peninsula

Alasdair Whittle, Alex Bayliss, Frances Healy, Roger Mercer, Andy M. Jones and Malcolm Todd

West of the Wessex downland lies the very different terrain of the south-west. Hambledon Hill and Whitesheet Hill, on the very edge of the Chalk (Chapter 4), look west over the flat lands of the Blackmoor Vale and the Somerset Levels to the higher ground of the south-west peninsula. The Chalk runs out on the east Devon coast. In one way, the much older geology of the south-west serves to define its difference from what lies to the east, seen especially in the uplands from the Blackdown Hills and Quantocks east to Exmoor and Dartmoor, and on down to Bodmin Moor and West Penwith. The proximity of the sea is a salient characteristic of the region.

In many ways, a different Neolithic archaeology is encountered in the south-west, as recognised by many authors going back to Hencken (1932); full references are provided by Mercer (1986). Occupation sites, including artefact scatters and pits, are known in hilltop settings such as Hazard Hill and Haldon in Devon (Houlder 1963; Willock 1936; 1937; Gent and Quinnell 1999a; Griffith 2001), and now in lower-lying settings as well, such as Long Range and Hayes Farm, Clyst Honiton, both in east Devon, and Tregarrick Farm, Roche, Cornwall (Fitzpatrick *et al.* 1999, 138, 146–55; Frances Griffith, pers. comm.; Cole and Jones 2003). A rectangular structure has long been known from Haldon (Willock 1936), and another has been found more recently in a more low-lying setting at Penhale, Indian Queens, Cornwall (Nowakowski 1998; Pollard and Healy 2008). Long barrows and cairns are present in low numbers in both counties (G. Smith 1990; Fitzpatrick *et al*. 1999, 213–16; Mercer 1986, 57; Johnson and Rose 1994, 26; Herring and Kirkham forthcoming; Higginbotham 1977; Herring and Thomas 1988; G. Berridge 1983).

While features like these serve to link the region to practices farther east, the monumental record in Cornwall is dominated by the rather different architectures of quoits or portal dolmens and entrance graves (Daniel 1950; Barnatt 1982; Ashbee 1982; Mercer 1986; Tilley and Bennett 2001). In Cornwall, greenstones used for axehead production are another distinctive feature. While implements have over the years been assigned to petrological Groups I, Ia, II, IIa, III, IIIa, IV, IVa, XVI, XVII and XIX, all attributed to Cornish sources, numerous artefacts made from a diversity of ungrouped greenstones are also likely to have originated in the peninsula (e.g. Davis *et al.* 1988, 16–18). Extraction and manufacturing sites remain elusive, an experience variously attributed to rising sea levels, later quarrying and the lack of distinctive knapping debris deriving from pecking coarse-grained rocks rather than flaking fine-grained ones. The likelihood of their production from beach pebbles rather than extracted rock has been persuasively argued by Peter Berridge (1993), and their probably diverse origins have been reinforced by Mik Markham's investigation of Cornish dolerite outcrops as well as of the artefacts themselves (2000).

The enclosures of the south-west (Fig. 10.1) typify this mixture of similarity to and difference from adjacent parts of Britain. The known causewayed enclosures of Membury, Hembury and Raddon, and the possible examples of Broadclyst and Nether Exe, together with the fragmentary site of High Peak, all lie in mid- and east Devon, broadly speaking in the catchments of the rivers Axe, Otter and Exe (Griffith 2001). Their investigation goes back to the work of Dorothy Liddell at Hembury, starting in 1930 (Liddell 1930). Many discoveries, however, have been much more recent. Raddon, for example, was only detected by aerial photography in 1986 and confirmed by excavation in 1994 (Griffith 2001, 72–3; Oswald *et al*. 2001, 150). In south-east Cornwall, between the East Looe River and the Fowey, two Neolithic enclosures have been claimed. On Bury Down, Lanreath, a badly degraded interrupted bank and ditch lie outside a much better preserved round; two sections across the outer earthwork yielded no artefacts (Ray 2001, 53–8). In Barcelona High Field, Pelynt, surface collection and a single ditch section at an ovoid enclosure, probably with four entrances, yielded a blade-based flint industry (Ray 2001, 58–9). Both enclosures may be Neolithic, but the case remains to be proved. West of these, only tor enclosures are so far known, and their recognition goes no further back than the pioneering work of Roger Mercer at Carn Brea near Redruth in the early 1970s (Mercer

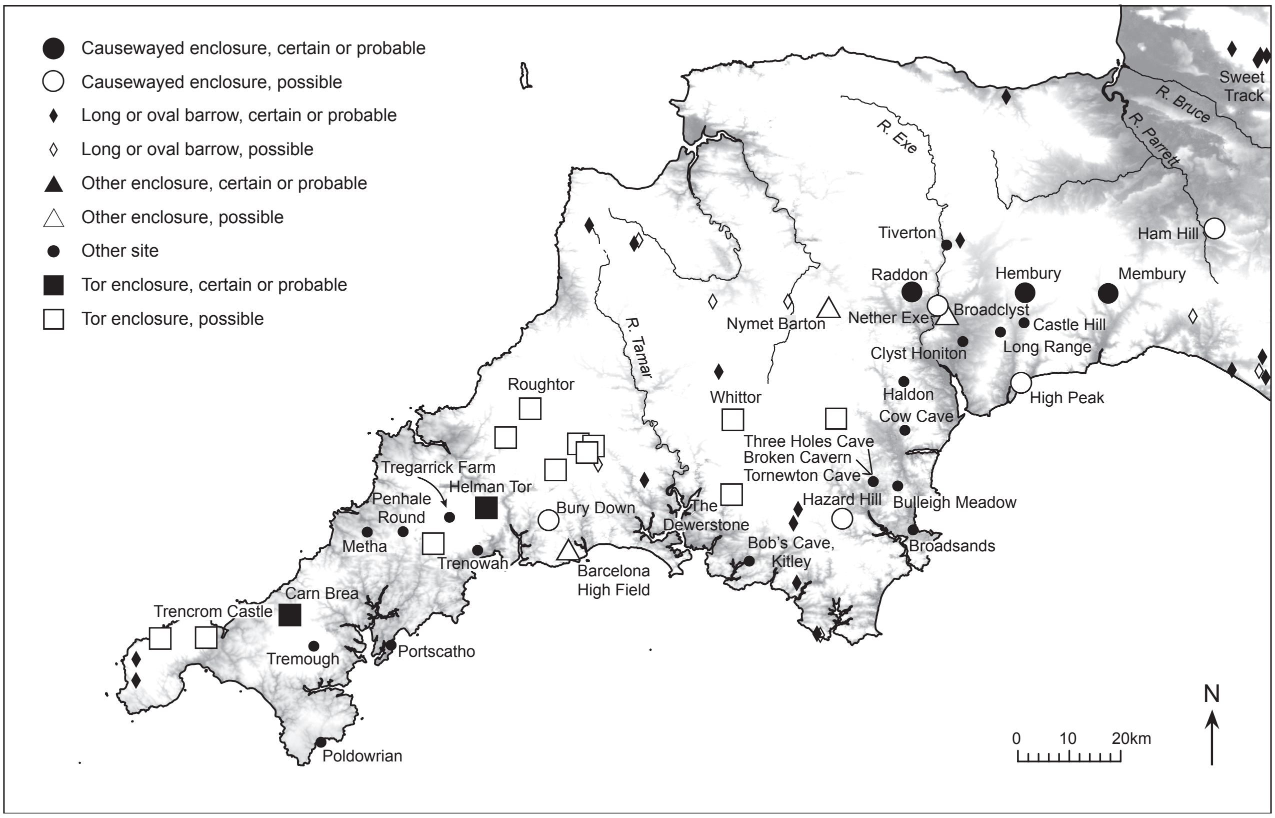


Fig. 10.1. The south-west showing causewayed enclosures, long barrows and other sites mentioned in Chapter 10.

Fig. 10.2. Membury. Excavation of ditch terminal in progress. Photo © Martin Tingle.

1981a), to be followed by the positive identification as Neolithic of Helman Tor, Lanlivery, in 1986 (Mercer 1997). Subsequently, Whittor and the Dewerstone on the west side of Dartmoor (Mercer 1997, 5; Griffith 2001, 70–1), Roughtor on Bodmin Moor, and Trencrom above St Ives on the east side of West Penwith (Mercer 1997; Griffith 2001), have all been plausibly advanced as Neolithic enclosures. Other suggested candidates are in the literature but the distribution is surely incomplete (Griffith 2001; Mercer 2001; Ray 2001). It is notable, but suspicious, for example, that there are so far no candidates either from Exmoor (including the Brendon Hills) or the Quantocks.

10.1 Membury, Devon, ST 2730 0320

Location and topography

The enclosure lies some 14 km inland on a hilltop at 190 m OD, overlooking the Yarty, a tributary of the Axe (Fig. 10.1) and commanding a view of the landscape to the south and west. The superficial geology is Clay-with-Flints which overlies part of a band of Chalk running from Membury to Furley, which is a source of high-quality flint, material from which has been identified macroscopically in local Mesolithic and Neolithic industries (Newberry 2002, 6–10).

History of investigation

A Neolithic presence at the site was first recognised in 1986 in the course of fieldwalking by Nan Pearce, who located pottery there. This led to a small excavation by Peter Berridge, who found a small ditch- or pit-like feature, containing South-Western style or Hembury Ware pottery. Two further attempts by Martin Tingle to resolve the character of the feature in 1994 and 1998 were inconclusive, although four pits containing South-Western style pottery, struck flint and chert were found in the second season. In 2000 it was possible to strip an area sufficiently large to reveal a 25 m-long stretch of ditch running along below the highest part of the hill (Fig. 10.2). The ditch had probably originally been dug in short segments before being made into a more continuous feature. It was severely truncated by ploughing and survived to only 0.40–0.50 m deep. The ditch fill included dense flint nodules, especially on its inner side, suggesting the revetment of an inner bank. There was struck flint and chert, and two scrapers and a leaf arrowhead were found at the same location within the ditch fill. Only three indeterminate sherds were recovered, and no animal bone was present, soil conditions being acidic (Tingle 2006). Chalk flint was more abundant in the pits, while chert and flint from the Clay-with-Flints dominated in the ditch. Blades were less frequent in the ditch than in the pits. Pottery fabrics were all local. The pits contained charred wheat and barley grains as well as charred hazelnut shells, which were unfortunately not available for dating at the appropriate time. While the artefacts from the pits clearly place them in the earlier fourth millennium, the date and character of the ditch may call for further elucidation.

10.2 Hembury, Payhembury, Devon, ST 1125 0298

Location and topography

Hembury sits at the end of one of the southernmost spurs of the Blackdown Hills, at 255 m OD, overlooking the broad catchment of the Exe, and locally the valleys of the Otter and Tale. It is some 17 km inland (Fig. 10.1). Its geology is Greensand overlying lias and marls, and there is a Clay-with-Flints capping.

History of investigation

The spur is dominated by an impressive Iron Age hillfort with a 'colossal triple rampart' (Liddell 1930, 40). This had long been recognised at the time when Dorothy Liddell began her research on the hill (Figs 10.3–4). Sister-in-law of Alexander Keiller, she had already worked in the team at Windmill Hill, Wiltshire, in the 1920s (Fig. 3.3; Todd 1984a), and she had the services on site of W.E.V. Young, Keiller's foreman there (Fig. 10.5). The project at Hembury was initiated by the Archaeological Section of the Devonshire Association, to be joined very quickly by the Devon Archaeological Exploration Society, as an investigation of the hillfort. 'A new paragraph to the history of our country during the obscure period which immediately precedes the coming of the Romans,' this was the largest programme of fieldwork in Devon yet attempted (Newman and Radford 1930).

The hillfort forms a long, narrow, oval, enclosing some 2.5 ha. Roughly across the middle of the interior lie two smaller earthworks. The first season in 1930 involved the excavation of a number of exploratory cuttings, focused principally on these. Initial results, gained from an unforgiving subsoil which made detection of ditch edges and other features very difficult (Liddell 1930, 41), suggested Iron Age structures and finds, but there were features under the transverse banks, and pottery of a then unknown type. Lithics were abundant, principally of flint, with a few of chert and other stones, and included 20 leaf arrowheads. Although these were recognised as Neolithic, it was argued at this stage that they might have been used by the Iron Age inhabitants (Liddell 1930, 46).

The second season (with further 'steady toiling' by the volunteers: Liddell 1931, 90) extended cuttings in the area of the transverse banks and began a long cutting at the south end of the interior. This led to the definite identification of a portion of the ceramic assemblage as Neolithic, notably from occupation, principally in the form of pits, at the southern end of the spur. More lithics were found, including leaf-shaped arrowheads and polished flint axes associated with the Neolithic pottery. A portion of substantial ditch which did not belong to the transverse banks was very strongly suspected to be of Neolithic date, and compared to ditches at Windmill Hill and The Trundle (Liddell 1931, 106–7). A timber structure, called a 'guardhouse' in the expectation of an Iron Age date, was located within the line of the ditch.

The third season in 1932 broadened knowledge of

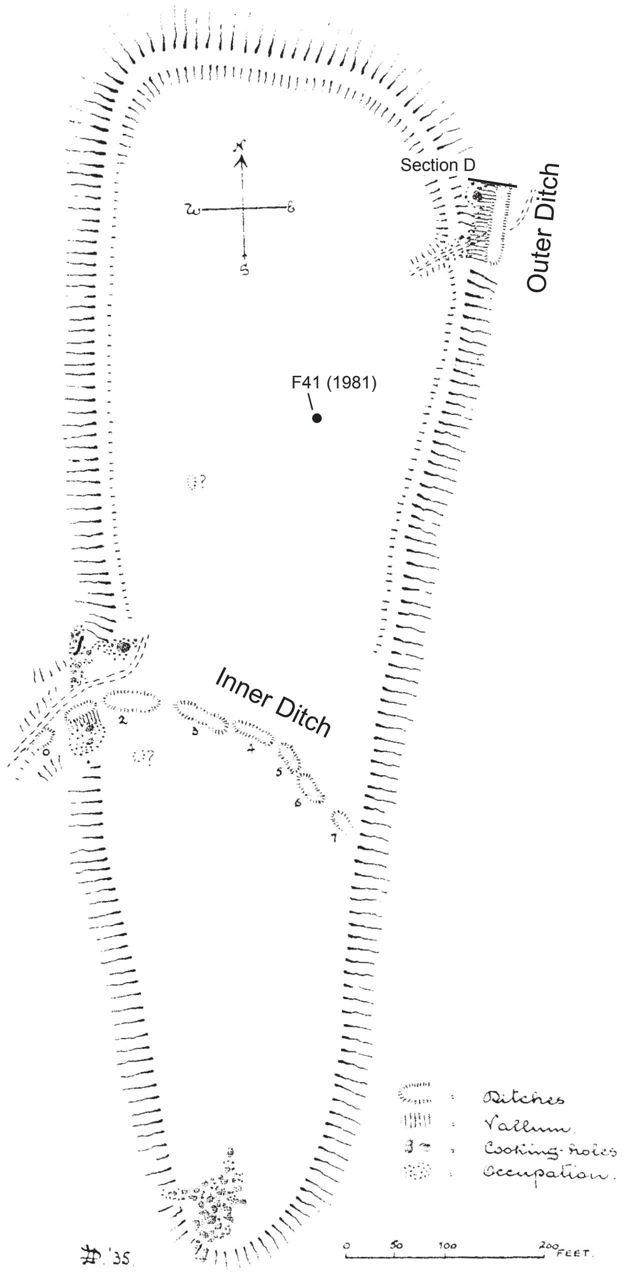


Fig. 10.3. Hembury. Schematic plan showing extent of Neolithic and possibly Neolithic features. After Liddell (1935, fig. 15), with features added from Todd (1984a, fig. 3).

the southern occupation area, established the presence of further Neolithic occupation in the area of the west ends of the transverse banks and the main hillfort entrance, added two more portions of 'characteristic interrupted' Neolithic ditch to the one found in the previous season (Liddell 1932, 162), and uncovered the full extent of the timber structure, now firmly assigned to the Neolithic phase (Liddell 1932, plate IV). The transverse banks and their ditches were now seen as of very late Iron Age or Belgic date. The 'big Neolithic ditch which conforms absolutely to the Windmill Hill type both in size and shape and in being divided into short lengths' (Liddell 1932, 169) was formed of segments up to 17 m long, some 5 m wide, and up to 2 m deep. This was a very substantial earthwork (Figs 10.6–7). It is unclear whether it was part of a complete circuit, or cut off the spur. In either case it would have defined an area of about a hectare (Mercer 1999, 150). The bank accompanying the inner ditch was not investigated to any extent, but its presence was noted, very baldly, near the west entrance of the hillfort (Liddell 1932, 170), and brief reference was made to its effect on the fill of the inner ditch (Liddell 1932, 170). The layout of other cuttings (e.g. Liddell 1932, plate IV; 1935, plate XXI) was not really conducive to its proper investigation.

In 1934–5, further small explorations were made in the principal areas so far excavated, without major surprises, but including the addition of useful detail on the layout of the inner ditch, of which eight segments were identified (Liddell 1935, fig. 15), and on its fill. The ditch was generally steep-sided and flat-based. Its primary fill seems to have been natural, in part at least consisting of 'washed silt' (Liddell 1932, 170). The 1934–5 cuttings emphasised the 'inevitable layer of burnt matter, crackles, sandstone, branches and twigs which had scorched the surrounding sand red', as in section 1 in cutting XIIc across segment 1, above the 'rapid silt from the vallum' (Liddell 1935, 138; see also Liddell 1935, figs 5–6 across segments 6 and 7). So it looks as though burning was represented in all the investigated parts of the inner ditch. Charcoals in these deposits included oak, ash and hazel, and there is some indication of burnt bank material; the whole has subsequently been interpreted as the remains of a timber framework reinforcing the front edge of the inner bank, destroyed in a violent attack (Mercer 1999, 150–1; cf. I. Smith 1971). There is a marked asymmetry in the middle fills of at least some of the ditch sections, further suggesting the presence of an inner bank (Liddell 1935, figs 5–6). Above this the ditch was 'normally silted-in' (Liddell 1935, 138).

More extensive cuttings in the area of the east entrance of the hillfort (at its north-east corner) led to the further unexpected discovery of an outer Neolithic ditch, unbroken by a causeway for more than 24 m (80 ft). It was mostly steep-sided and flat-based, and where fully exposed, up to 2 m deep (7 ft) (Liddell 1935, 148–9). Remains of a low, broad, bank were found on the inner side (Liddell 1935, 150). The fill of the ditch showed rapid infilling at its base, followed by 'the burnt layer … as in the first ditch, staining the sand bright red' (Liddell 1935, 149). One portion, however, lacked the burnt layer and appeared to have been backfilled (Liddell 1935, 149). A few pits and postholes were found in the vicinity of the outer ditch; some Neolithic occupation material overlay the bank (Liddell 1935, 152). The continuation of the line of the outer ditch is unknown. One suggestion is that it too curved to cut off the spur like the inner ditch, speculatively thus defining some 2.5 ha (Mercer 1999, 150; Oswald *et al*. 2001, fig. 2.20).

Isobel Smith reinterpreted some of Liddell's sections as showing recuts made at the outer edge of the inner ditch when it was largely silted, some time after the burnt material had entered it (1971). Liddell's tables show that

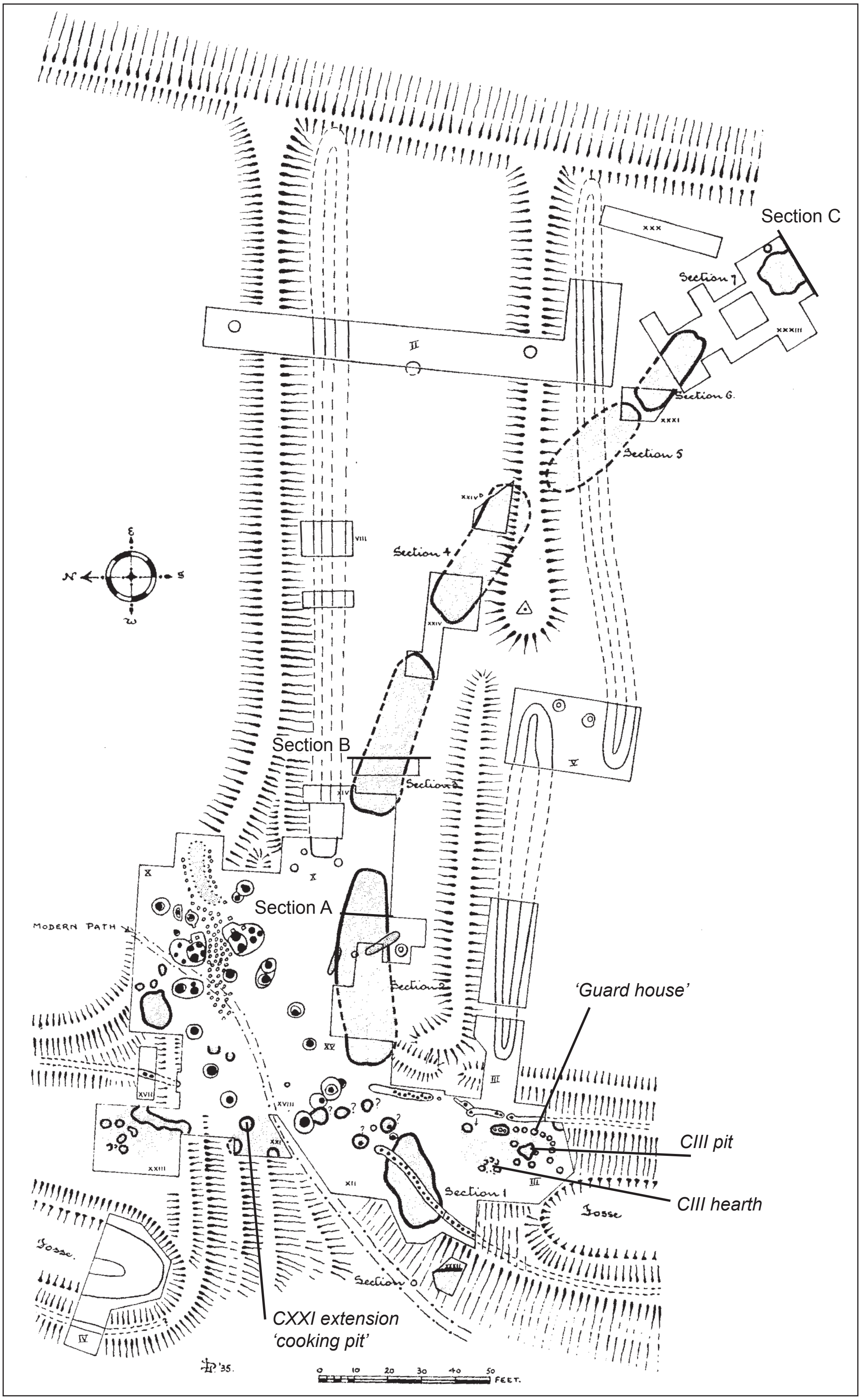


Fig. 10.4. Hembury. West entrance and centre of hillfort, showing Neolithic features. Note that north is to the left. After Liddell (1935, pl. XXI).

Fig. 10.5. Hembury. The type-written caption to the original of this montage of prints reads 'Miss Dorothy Liddell as skilled excavator, meticulous surveyor and administrator. On the right, Miss Liddell discusses arrangements with Rear-Admiral O'Dogherty'. From the collections of the Royal Albert Memorial Museum, Exeter.

artefacts were concentrated in the upper spits, suggesting that many of them came from the recuts. The substantial Neolithic pottery assemblage recovered in 1930–5 made this the type site for Hembury Ware, defined by Piggott (1954, 67–8) and later broadened to the South-Western style by Whittle (1977, 77), characterised by bag-shaped, often closed or neutral, forms with simple upright or everted rims, a variety of lugs, rare shoulders or cordons, and the near-absence of decoration. A portion of the assemblage was identified at the time of excavation as of finer, mainly red, ware, with trumpet lugs and stone temper akin to imported greenstone axes (Liddell 1935, 162–3). This was subsequently identified as gabbroic ware, the clay for which derived from the Lizard peninsula in south-west Cornwall, with the suggestion that this pottery constituted up to 20 per cent of the assemblage (Peacock 1969).

The flint and chert assemblage includes a normal range of production waste, scrapers and arrowheads, some made on Chalk flint, much of which matches material from sources 10 km to the east in the Widworthy/Wilmington area (Newberry 2002, 12–13), and there were axeheads of both flint and greenstone.

Among the many other features of interest in Liddell's excavations at Hembury, the discovery of carbonised grain in pits (e.g. Liddell 1935, 163) has been seen as particularly significant. Some of this was tentatively identified as 'a primitive form of the Bread wheat Race, *T. vulgare*' (J. Percival 1931). Nearly twenty years later, Hans Helbaek examined a small sample of 'Neolithic' wheat from Hembury and found that it consisted mainly of spelt, that its composition was inconsistent with a Neolithic date, and that it was likely to be Iron Age, having been informed by Lady Aileen Fox that the pit in question was overlain by an Iron Age rampart (Helbaek 1952, 208). Finds of *Triticum spelta* have subsequently proved elusive on other sites of the period, and there has since been debate as to the provenance and precise identification of the sample which Helbaek examined. The Hembury file in the Royal Albert Museum, Exeter, includes a letter written by Lady Fox after the publication of Helbaek's article saying that the grain did indeed come from a Neolithic context. There is a note by Helbaek, dated 1952, which reads 'Impressions of spikelet parts of Emmer (Triticum dicoccum) were found in pottery sherds. The carbonized grain exhibited in the Hembury case is of the same species'. A letter written in 1988 by the then curator records that Vanessa Straker 'has searched all the grain samples in our collections, but these do not include any spelt'; a letter from Vanessa Straker herself later that year states that she could find only emmer chaff among Hembury material placed by Helbaek in the National Museum in Copenhagen. On this showing, it seems possible that there was no spelt in Neolithic contexts at Hembury, and that its cultivation in Britain in this period is yet to be demonstrated. Charred grain from Neolithic contexts at Hembury is no longer readily attributable to individual features. It was not therefore thought appropriate to date any of it in the course of this project.

Liddell died in 1938 and a final report was never published. In the 1980s, Malcolm Todd, then at Exeter University, took up the challenge with the aim of making good that lacuna (Todd 1984a, 253). To this end, excavations were made in 1980–3 in the centre of the northern interior

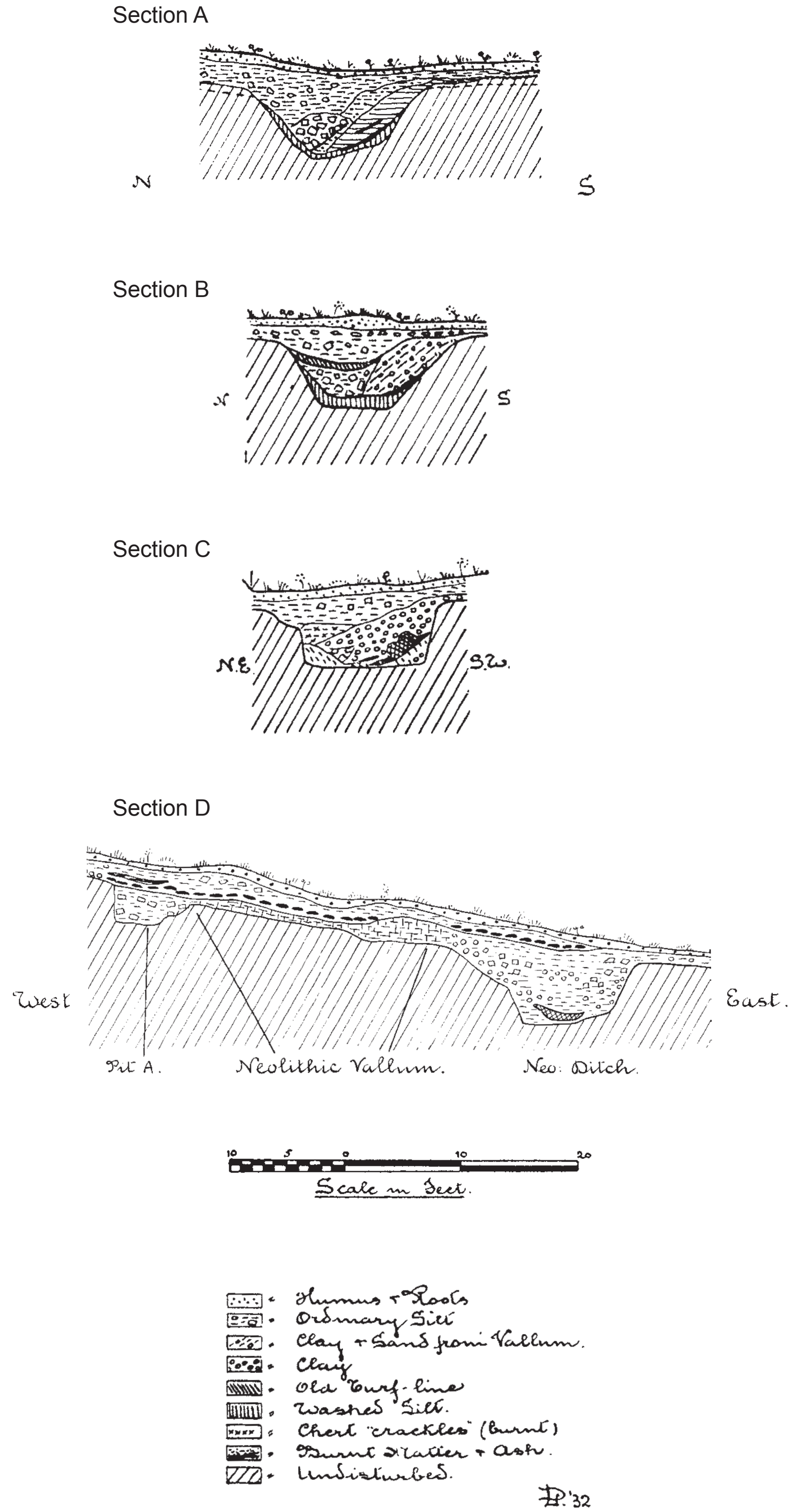


Fig. 10.6. Hembury. Sections of inner ditch in cuttings X (A), XX (B) and XXXIII (C) and of the outer ditch in cutting XXXIII (D). After Liddell (1931, fig. 3; 1932, pl. VIII; 1935, fig. 6, pl. XXIX).

of the hillfort, in an area untouched by Liddell; and one small section was cut across the northern transverse bank. A number of Neolithic pits and shallow hollows were identified, under Roman military buildings (Todd 1984a, figs 2–3). One elongated feature over 5 m long was seen as a Neolithic ditch (Todd 1984a, 255–6, figs 3–4), although it lacked Neolithic artefacts. The section across the northern of the two transverse banks and ditches which

Fig. 10.7. Hembury. The type-written caption to the original print reads 'Miss Liddell in a rare moment of relaxation at Hembury'. From the collections of the Royal Albert Memorial Museum, Exeter.

divide the hillfort into two parts demonstrated that it, and, by inference, the southern one too, were of post-medieval date, possibly associated with an annual fair which used to be held on the hill (Todd 2002).

Previous dating

Three bulk samples of unidentified charcoal from the 1930s excavations were submitted to the British Museum by Lady Aileen Fox in the early 1960s and radiocarbon dates obtained (Fox 1963; Barker and Mackey 1963; 1968). These samples were prepared and dated by GPC of acetylene, as described by Barker and Mackey (1959).

Reassessment of existing dates

Two of the three samples came from the fills of the inner ditch and one from the occupation area at the southern tip of the spur. The results, which have been widely quoted and discussed as supporting a very early date for the enclosure (e.g. Mercer 1981a, 188), in fact only provide *termini post quos* for the Neolithic activity on the hill since the charcoal was unidentified and may have included material with a significant age offset.

Objectives of the dating programme

Despite the vintage of the excavations and the interim nature of their publication (Liddell 1930; 1931; 1932; 1935), the Hembury archive appeared to offer the potential to provide refined estimates for the dates of construction and use of different elements of the complex. The principal objectives of the dating programme were to estimate the date of the construction of the inner ditch, to date the construction of the outer ditch, to confirm whether the putatively Neolithic features north of the inner ditch were indeed of such a date, to determine the date of the two identified areas of Neolithic occupation, and to establish the duration of the complex as a whole.

Sampling strategy and simulation

Bone preservation was minimal. Of necessity, the samples selected for radiocarbon dating consisted of charcoal, charred plant remains and carbonised residues adhering to the interior surfaces of Neolithic vessels. That it was possible to make such a selection is a tribute to the care with which the excavations were conducted and the finds curated over the years since.

Material suitable for dating from the Neolithic ditches was restricted and samples were submitted from all available deposits. There was more choice of material from the southern occupation, and so a series of simulation models were constructed to determine the most efficient sampling strategy (Fig. 10.8).

Results and calibration

Full details of the 33 radiocarbon determinations from Hembury are provided in Table 10.1.

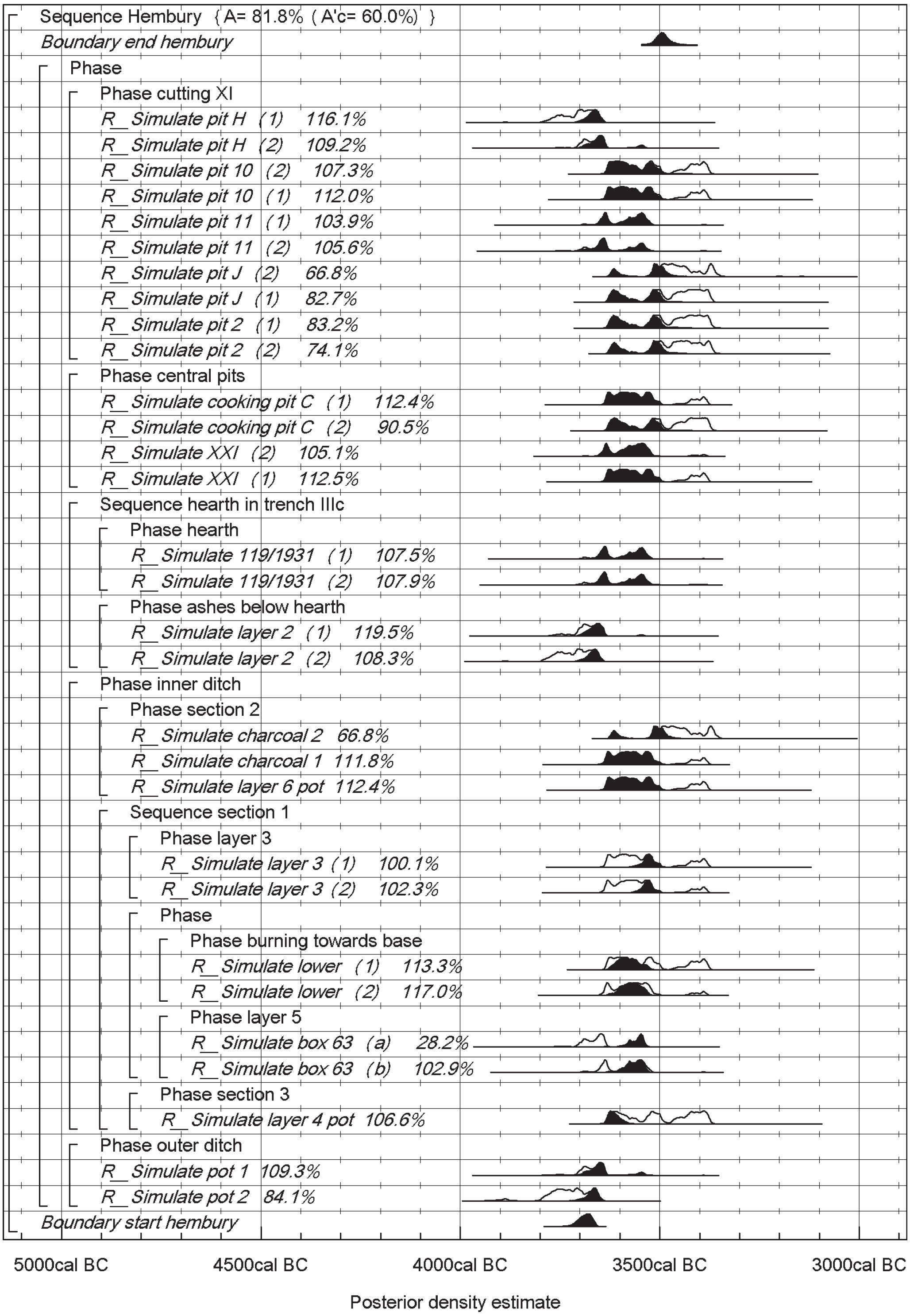


Fig. 10.8. Hembury. Probability distributions of simulated dates. Each distribution represents the relative probability that an event occurred at a particular time. For each of the dates two distributions have been plotted, one in outline which is the result produced by the scientific evidence alone, and a solid one which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution 'start hembury' is the estimated date when Neolithic activity at Hembury started. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Analysis and interpretation

The overall structure of the chronological model for Neolithic activity at Hembury is shown in Fig. 10.9. Figure 10.10 shows the components of this model relating to the ditches. Figure 10.11 shows the components relating to the occupation areas, and Fig. 10.12 shows the component relating to the putative Neolithic activity north of the inner ditch.

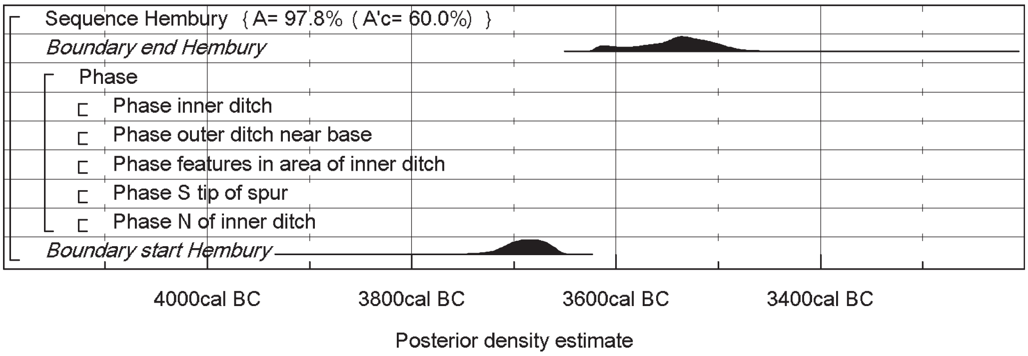


Fig. 10.9. Hembury. Overall structure of the chronological model. The component sections of this model are shown in detail in Figs 10.10–12. The large square brackets down the left-hand side of Figs 10.9–12, along with the OxCal keywords, define the overall model exactly.

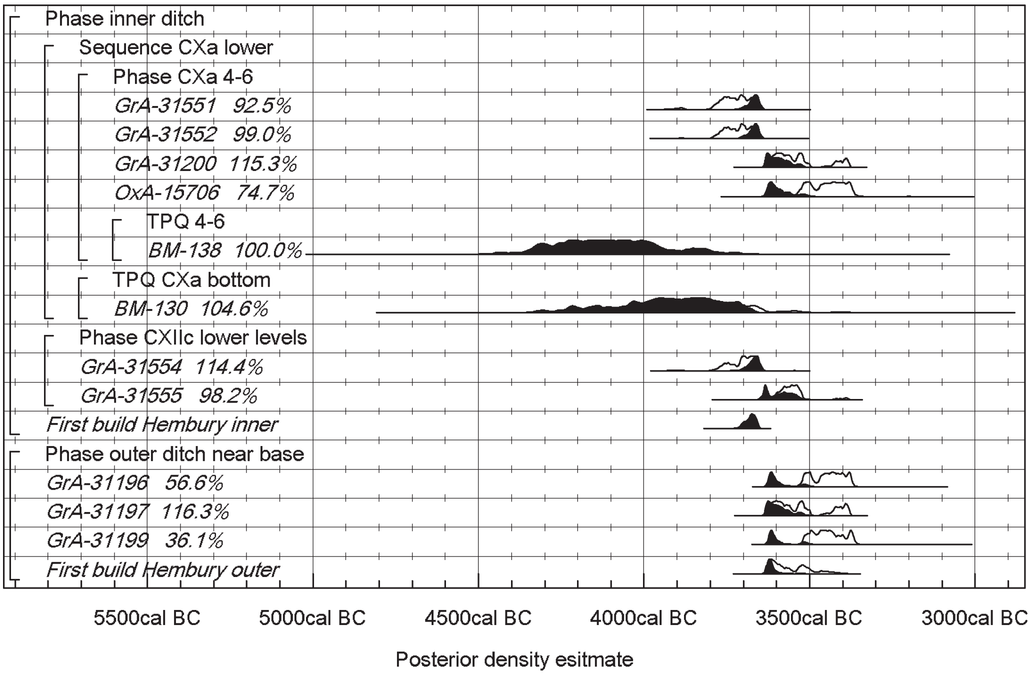


Fig. 10.10. Hembury. Probability distributions of dates from the Neolithic ditches. The format is identical to that of Fig. 10.8. The overall structure of this model is shown in Fig. 10.9, and its other components in Figs 10.11–12.

The inner ditch. Samples were dated from two cuttings (Xa and XIIc) across different segments of the inner ditch (Figs 10.4 and 10.6). Two of the bulk samples submitted by Lady Fox came from cutting Xa, BM-130 from the base of the ditch and BM-138 from spits 4–6. Given the pitch of the burnt deposits at the inner edge of the ditch (Fig. 10.6), spits 4–6 would have spanned their entirety. Two statistically consistent radiocarbon determinations have been obtained from single fragments of short-lived charcoal from these spits (GrA-31551–2: T'=0.0; T'(5%)=3.8; ν=1). Residues from two sherds from different Neolithic vessels from spit 6 also produced statistically consistent measurements (GrA-31200 and OxA-15706: T'=1.0; T'(5%)=3.8; ν=1), although these are rather later than the dates from the charcoal samples. OxA-15706 produced a very low combustion yield, although the consistency of this result with the others from these deposits may suggest that the determination is accurate. The difference in age between the charcoal and residue measurements would accord with the hypothesis that the former derived from a burnt rampart structure collapsed into the ditch, and hence date the construction of the earthwork rather than the deposit in which they were found, while the latter date the deposit itself.

Two fragments of short-lived charcoal from the lower levels of the ditch in cutting XIIc produced statistically inconsistent radiocarbon determinations (GrA-31554–5: T'=7.4; T'(5%)=3.8; ν=1). At least some of this charcoal probably derives from a context described in Liddell's notebook as 'Bottom reached at East end where a shelf of green Sand has above it a layer of stone on which is a thick layer of burnt matter – large pieces of wood – burnt stone & frags burnt pottery being compressed into wine coloured burnt sand'. Two further determinations from cutting XIIc produced Iron Age dates (GrA-31556–7). This segment was cut by an Iron Age palisade (Liddell 1931, plate X; 1935, 137, plate XXII, fig. 3). Given that spits were one foot deep

Table 10.1. Radiocarbon dates from Hembury, Devon. Posterior density estimates derive from the model defined in Figs 10.9–12.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Inner ditch							
BM-130	Sample 1	'Each sample consisted of small pieces of charcoal, and had a label in Miss Liddell's handwriting, which enabled it to be related to deposits mentioned in the reports' (Fox 1963)	'The bottom of the Neolithic ditch, Cutting XA'. Described by Liddell (1931, 105)	5100±150		4320–3630	*4235–3675*
BM-138	Sample 2	'Each sample consisted of small pieces of charcoal, and had a label in Miss Liddell's handwriting, which enabled it to be related to deposits mentioned in the reports' (Fox 1963)	'CXA, layers 4–6. Burnt layers with Neolithic pottery'. Liddell's layers were spits 1 ft deep, so that spits 4–6 spanned the burnt deposits in the ditch (Liddell 1931, 105)	5280±150		4450–3710	*4375–3765*
GrA-31551	CX a ditch layers 4–6. Charcoal from side of ditch /A	Single fragment *Corylus avellana*	CX a ditch layers 4–6, Section 2 of inner ditch. 'Layers' were 1 ft spits, so that layers 4–6 would have encompassed the lenses of burnt material shown in the published sections (Liddell 1931, 105–7, fig. 3). The stratigraphic position and extent of the burnt deposits of which the sample forms a part suggest that they may have derived from the burning of a wooden rampart structure	4945±40	−25.6	3800–3640	*3705–3640*
GrA-31552	CX a ditch layers 4–6. Charcoal from side of ditch /B	Single fragment *Corylus avellana*	From the same context as GrA-31551	4940±35	−27.0	3800–3640	*3705–3640*
GrA-31200	CX a & exts layer 6 /A	Neolithic Bowl sherd with well preserved internal residue, from a different vessel to sample for OxA-15706	CXa & exts layer 6, Section 2 of inner ditch. 'Layers' were 1 ft spits, so that 'layer' 6 would have included some of the lens of burnt material shown in the published sections (Liddell 1931, 105–7, fig. 3)	4750±35	−31.1	3640–3370	*3640–3520*
OxA-15706	CX a & exts layer 6 /B	Neolithic Bowl sherd with well preserved internal residue, from a different vessel to sample for GrA-31200 Certificate: 'OxA-15706 produced a very low combustion yield (247 µg C from 6.8 mg burn weight), therefore there is something of a health warning on this result.'	From the same context as GrA-31200	4690±50	−26.6	3640–3360	*3640–3550* (*86%*) or *3540–3500* (*9%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-31554	CXII c extn lower levels of ditch /A	Single fragment *Quercus* sp. roundwood	CXII c extn, lower levels of ditch, Section 1 of inner ditch. Briefly described in interims (Liddell 1931, fig. 4; 1932 pl. X; 1935 137, pl. XXII, fig. 3). Liddell's 1934 notebook reads (4/8/1934) 'Bottom reached at East end where a shelf of green Sand has above it a layer of stone on which is a thick layer of burnt matter — large pieces of wood — burnt stone & frags burnt pottery being compressed into wine coloured burnt sand'. The stratigraphic position and extent of the burnt deposits of which the sample forms a part suggest that they may have derived from the burning of a wooden rampart structure	4925±35	−24.5	3790–3640	*3705–3640*
GrA-31555	CXII c extn lower levels of ditch /B	Single fragment *Corylus avellana*	From the same context as GrA-31554	4790±35	−25.9	3650–3510	*3650–3530*
GrA-31556	CXII c layer 3 of Neo ditch /A	Single fragment *Quercus* sp. sapwood	CXII c, spit 3 of Section 1 of inner ditch. Briefly described in interims (Liddell 1931, fig. 4; 1932 pl. X; 1935 137, pl. XXII, fig. 3'. Spits were 1 ft deep, so that 'layer' 3 would have included part of the Iron Age palisade slot which cut the ditch (Liddell 1932 pl. X)	2465±35	−25.5	770–400	
GrA-31557	CXII c Layer 3 of Neo ditch /B	Single fragment *Quercus* sp. sapwood	From the same context as GrA-31556	2485±35	−25.7	790–410	
Outer ditch							
GrA-31196	CXXVIII c layer 6 ditch	Neolithic Bowl body sherd with well preserved residue	CXXVIII c ditch spit 6. One of the lowest pits in the outer ditch (Liddell 1935, 148–9, pl. XXIX)	4685±35	−27.7	3630–3360	*3635–3560* (*84%*) or *3530–3495* (*11%*)
GrA-31197	CXXVIII Neo black layer /A	Neolithic Bowl body sherd with well preserved residue, from a different vessel to the sample for GrA-31199	CXXVIII, Neo black layer. This was a lens of burnt material, derived from the interior, near the base of the only excavated segment of the outer ditch (Liddell 1935, 148–9, pl. XXIX)	4740±35	−26.9	3640–3370	*3640–3545* (*88%*) or *3540–3515* (*7%*)
GrA-31199	CXXVIII Neo black layer/B	Neolithic Bowl body sherd with well preserved residue, from a different vessel to the sample for GrA-31197	From the same context as GrA-31197	4660±40	−27.3	3630–3350	*3635–3560* (*82%*) or *3530–3490* (*13%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Discrete features							
GrA-31545	Ch 35. Cutting III c charcoal from pit (hearth) /A	Single fragment *Corylus avellana*	CIII c layer 2. From pit (hearth) containing much burnt material, Neolithic Bowl pottery, and lithics inc. 2 leaf arrowheads, under the N butt of the IA rampart at the S side of the W entrance, beside a hearth, within a U-plan setting of postholes interpreted as Neolithic structure. Both features were at the edge of the 1931 cutting, so that part of each was excavated in 1931 and part in 1932. The excavation of more of the pit in 1932 indicates that the 1931 plan, which shows it complete outline, was subsequently revised. In 1932 it was described as a mound of white wood ash and charcoal 6 ft in extent and 2 ft deep, with two charred oak branches lying across it (Liddell 1931, 99, figs 2–3: A; 1932, 170–2, pls IV, VII)	4770±35	−24.8	3650–3380	*3640–3525*
GrA-31546	Ch 35. Cutting III c charcoal from pit (hearth) /B	Single fragment Pomoideae	From the same context as GrA-31545	4735±35	−23.7	3640–3370	*3640–3545* (*88%*) or *3540–3515* (*7%*)
GrA-31548	CIII e layer 2 charcoal & earth from ashes below hearth /A	Single fragment *Betula* sp.	CIII e layer 2. Charcoal & earth from ashes below hearth. 'Hearth' was a circle of stones laid flat and tightly packed around a mound of charcoal, ash and fire-cracked chert, under the N butt of the IA rampart at the S side of the W entrance, beside a 'cooking pit' which was the context of GrA-31545 and -31546, within a U-plan setting of postholes interpreted as Neolithic structure. Both features were at the edge of the 1931 cutting, so that part of each was excavated in 1931 and part in 1932. (Liddell 1931, 99, figs 2–3: C; 1932, 170–2, pls IV, VIII)	2485±35	−26.9	790–410	
GrA-31550	CIII e layer 2 charcoal & earth from ashes below hearth /B	Single fragment *Betula* sp.	From the same context as GrA-31548	2635±35	−27.9	840–780	
GrA-31201	CXVI c cooking pit/A	Large fragment of charred hazelnut shell, from bag containing numerous fragments	CXVI c, cooking pit. One of several pits close to the inner ditch (Liddell 1932, 172, pl. V)	4805±35	−24.2	3660–3520	*3655–3615* (*39%*) or *3610–3525* (*56%*)
GrA-31204	CXVI c cooking pit/B	Large fragment of charred hazelnut shell, from bag containing numerous fragments	From the same context as GrA-31201	4825±35	−24.1	3660–3520	*3670–3620* (*53%*) or *3605–3525* (*42%*)
GrA-31559	CXXI extension charcoal & nuts (a)	Hazelnut shell fragment	CXXI extension, 'Cooking hole'. One of several pits close to the inner ditch (Liddell 1935, 136)	4845±35	−25.7	3700–3530	*3695–3625* (*76%*) or *3585–3535* (*19%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-31463	CXXI extension charcoal & nuts (b)	Hazelnut shell fragment	From the same context as GrA-31559	4750±35	−22.3	3640–3370	*3640–3520*
BM-136	Sample 3	'Each sample consisted of small pieces of charcoal, and had a label in Miss Liddell's handwriting, which enabled it to be related to deposits mentioned in the reports' (Fox 1963)	'CXIA, layer 3. Neolithic burnt layer. Described by Liddell (1931, 109, fig. 5). At S tip of spur. L3 was ash, charcoal and burnt turf sealed by an old turf line overlain by mass of broken chert interpreted as the remains of the Iron Age rampart. Hearths and cooking pits with Neolithic Bowl pottery and abundant flint industry also formed part of L3	5190±150		4350–3650	*4335–3700*
GrA-31206	CXI f cooking pit J /B	Large fragment of charred hazelnut shell from a different nut to CXI f cooking pit J /A, from bag containing numerous fragments	CXI f, pit J. One of numerous pits excavated on the southern tip of the spur, at least partly protected by the Iron Age rampart (Liddell 1931, 109, fig. 5, pl. XV)	4785±35	−28.8	3650–3380	*3645–3530*
GrA-31205	CXI f cooking pit J /A	Large fragment of charred hazelnut shell from a different nut to CXI f cooking pit J /B, from bag containing numerous fragments	From the same context as GrA-31206	4795±35	−25.8	3650–3510	*3650–3525*
GrA-31466	Ch 58. CXI d extn, pit 2 layer 2 charcoal (a)	Single fragment hazelnut shell	CXI d extn, pit 2, layer 2. One of numerous pits excavated on the southern tip of the spur, at least partly protected by the Iron Age rampart (Liddell 1931, 111, fig. 5, pl. XXIV)	4770±35	−26.5	3650–3380	*3640–3525*
GrA-31467	Ch 58. CXI d extn, pit 2 layer 2 charcoal (b)	Single fragment hazelnut shell	From the same context as GrA-31466	4845±35	−24.0	3700–3530	*3695–3625* (*76%*) or *3585–3535* (*19%*)
GrA-31213	CXI f cooking pit 10 /A	Large fragment of charred hazelnut shell from a different nut to sample for GrA-31094	C XI f, pit 10. One of numerous pits excavated on the southern tip of the spur, at least partly protected by the Iron Age rampart (Liddell 1931, 109, fig. 5; 1932, pl. XV)	4880±40	−24.7	3720–3540	*3705–3630* (*93%*) or *3555–3540* (*2%*)
GrA-31094	CXI f cooking pit 10 /B	Large fragment of charred hazelnut shell from a different nut to sample for GrA-31213	From the same context as GrA-31213	4845±40	−25.5	3710–3530	*3700–3625* (*72%*) or *3595–3530* (*23%*)
GrA-31207	CXI g cooking pit 11 (a)	Large fragment of charred hazelnut shell from a different nut to sample for GrA-31209, from bag containing numerous fragments	CXI g, cooking pit 11. One of numerous pits excavated on the southern tip of the spur, at least partly protected by the Iron Age rampart (Liddell 1931, 109, fig. 5; 1932, pl. XV)	4820±35	−28.8	3660–3520	*3665–3615* (*49%*) or *3610–3525* (*46%*)
GrA-31209	CXI g cooking pit 11 (b)	Large fragment of charred hazelnut shell from a different nut to GrA-31207, from bag containing numerous fragments	From the same context as GrA-31207	4925±40	−29.9	3790–3640	*3705–3635*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-31210	CXI k cooking pit H /A	Large fragments of charred hazelnut shell from a different nut to sample for GrA-31211, from bag containing numerous fragments	CXI k, pit H. One of numerous pits excavated on the southern tip of the spur, at least partly protected by the Iron Age rampart (Liddell 1931, 109, fig. 5; 1932, pl. XV)	4845±40	−24.9	3710–3530	*3700–3625 (72%)* or *3595–3530 (23%)*
GrA-31211	CXI k cooking pit H /B	Large fragments of charred hazelnut shell from a different nut to sample for GrA-31210, from bag containing numerous fragments	From the same context as GrA-31210	4855±40	−24.3	3710–3530	*3700–3625 (80%)* or *3585–3535 (15%)*
GrA-31544	H81 3 F41/A	Residue from one sherd of many, probably from a single coarse, lugged vessel in the South-Western style	H81 3 F41. From area north of inner ditch and west of outer ditch, in a cutting adjacent to Liddell's CXXXIV. In upper and mid fill of a shallow pit (F41) cut into a backfilled deeper pit (F90; Todd 1984, 257–8, figs 5–6) containing numerous South-Western style sherds, probably from a single coarse, lugged pot, possibly broken *in situ*, since rim sherds were found at the top	4505±40	−29.6	3370–3020	

(0.30 m), spit 3 would have encompassed the lower part of the palisade slot as well as burnt material in the Neolithic ditch fills. These measurements provide *termini post quos* for the overlying outer Iron Age rampart.

The model suggests that the inner ditch at Hembury was constructed in *3715–3650 cal BC* (*95% probability*; Fig. 10.10: *build Hembury inner*), probably in *3690–3655 cal BC* (*68% probability*).

The outer ditch. Three samples have been dated from the outer ditch, all residues on sherds of Neolithic Bowl pottery. Three different vessels have been dated. Two of the samples (GrA-31197, -31199) came from a lens of burnt material derived from the interior near the base of cutting XXVIII (Liddell 1935, plate XXIX). The third sample came from spit 6 in the same cutting and so may derive from the same deposit. The three measurements are statistically consistent (T'=2.5; T'(5%)=6.0; ν=2).

The model suggests that the outer ditch at Hembury was dug in *3640–3575 cal BC* (*95% probability*; Fig 10.10: *build Hembury outer*), probably in *3630–3605 cal BC* (*68% probability*).

Features in the area of the inner ditch. Eight radiocarbon determinations have been obtained from four features in the vicinity of the inner ditch. Two statistically consistent measurements have been obtained on single fragments of charred plant material from a 'cooking pit' inside a timber structure (the 'guardhouse': see above) (GrA-31545–6: T'=0.5; T'(5%)=3.8; ν=1). Two samples from below an adjacent hearth in the same structure have, however, yielded Iron Age dates (GrA-31548, -31550). Disparate dates for two features within the timber structure raise the possibility that it may have been built in the first millennium rather than the fourth, despite long acceptance of it as a Neolithic building (e.g. Darvill 1996c, 83). Two more 'cooking pits' have produced statistically consistent pairs of measurements, one from cutting XVIc (GrA-31201, -31204: T'=0.2; T'(5%)=3.8; ν=1), and the other from an extension to cutting XXI (GrA-31559, -31463: T'=3.7; T'(5%)=3.8; ν=1); both pits were just outside the inner ditch.

All these features seem to have been used in the 37th or 36th century cal BC (Fig. 10.11).

Features at the south end of the spur. Radiocarbon dates are available from six deposits in this area of occupation. BM-136, a bulk sample of unidentified charcoal from an occupation spread preserved beneath the Iron Age rampart, provides a *terminus post quem* for this activity. Statistically consistent pairs of radiocarbon measurements have been obtained from each of four 'cooking pits' in cutting XI (GrA-31466–7: T'=2.3; T'(5%)=3.6; ν=1; GrA-31205–6: T'=0.0; T'(5%)=3.8; ν=1; GrA-31094, -31213: T'=0.4; T'(5%)=3.8; ν=1; GrA-31210–1: T'=0.0; T'(5%)=3.8; ν=1). A fifth 'cooking pit' from cutting XI provided a pair of measurements which are statistically inconsistent (GrA-31207, -31209: T'=3.9; T'(5%)=3.8; ν=1), although this difference is sufficiently subtle that one of the measurements is probably simply a slight statistical outlier.

The occupation at the southern end of the spur also

appears to fall within 37th and 36th centuries cal BC (Fig. 10.11).

Pit north of the inner ditch. A single radiocarbon date has been obtained from a carbonised residue on a sherd, one of many, probably from a single, coarse, lugged vessel in the South-Western style, from the fill of a shallow pit in the area investigated by Malcolm Todd (Todd 1984a, 257–8, figs 5–6).

If this measurement is included in the overall model for Neolithic activity at Hembury, it has poor agreement (A=1.2%; Bronk Ramsey 1995). For this reason it has been excluded from the model, as it appears in fact to relate to later activity on the hill, in 3370–3020 cal BC (95% confidence; Fig. 10.12: GrA-31544). It should be noted, however, that a replicate measurement from residue on another sherd of this vessel failed to produce a radiocarbon determination, and so it is possible that the material dated was poorly preserved. This date seems rather later than most others relating to this type of pottery.

An interpretive chronology

The model defined in Figs 10.9–12 suggests that the inner ditch was built in *3715–3650 cal BC* (*95% probability*; Fig. 10.10: *build Hembury inner*), probably in *3690–3655 cal BC* (*68% probability*), and that the outer ditch was constructed in *3640–3575 cal BC* (*95% probability*; Fig. 10.10: *build Hembury outer*), probably in *3630–3605 cal BC* (*68% probability*). The difference between these estimates suggests that there was a gap of at least a generation, and probably two or three generations, between the construction of the earthworks of *20–120 years* (*95% probability*; Fig. 10.13: *gap ditches*) or *35–80 years* (*68% probability*). It is certain that the inner ditch came first (*100% probable*).

The principal phase of Neolithic activity appears to have ended in *3620–3485 cal BC* (*95% probability*; Fig. 10.9: *end Hembury*), probably in *3570–3495 cal BC* (*68% probability*). Overall the complex was in use for *35–230 years* (*95% probability*; Fig. 10.13: *use Hembury*), probably for *110–210 years* (*68% probability*).

The feature in the area north of the inner ditch (Todd 1984a) may indicate that there was a further episode of Neolithic activity on the hill after the enclosure went out of use (Fig. 10.12). If so, this was slight. There seems to have been no Peterborough Ware, Grooved Ware or Beaker pottery from the hill, and the only diagnostically post-Neolithic lithics were three barbed and tanged arrowheads.

Implications for the site

Hembury has been important in the Neolithic literature for a number of reasons, among them its material culture and the evidence for attack seen in the burnt deposits which occur throughout the excavated parts of the inner and outer ditches. The Bowl pottery from the site has helped to define the South-Western style, which, with its generally unshouldered forms, frequent lugs and dearth of decoration, differs from the traditions found farther east and north. Hembury has been seen as a centre to which a wide variety of artefacts were brought from distant sources, but further studies have served to qualify this considerably. Some of the flint could have been obtained locally (Newberry 2002), but there was at least some Chalk flint, and the distance over which stone axes came into the site is still unclear (A. Brown 1989). The import of gabbroic pottery remains a feature, and re-examination of the assemblage has indicated that vessels in other fabrics may also have been brought to the site (Quinnell 1999, 48). Hembury may be better seen as part of a series of networks, principally perhaps local ones. The evidence for burning in both ditches is very striking, though it may be an open question just what sort of reinforced bank or rampart can be reconstructed, and there are not the same quantities of leaf arrowheads here as at Crickley Hill (Chapter 9) or Carn Brea (this chapter). This has been taken by one author to question the scale of attack (A. Brown 1989, 48). Nonetheless, Roger Mercer (2006a, 70; and see Mercer 1999, 150–1) has noted ‘a large number (*c*. 80) of leaf-shaped arrowheads, many of which exhibited traces of of calcining through heat’, from the burnt ditch deposits.

The model allows different readings of the detail of the sequence. What was the order of ditch construction? Were the ditches constructed in anticipation of attack? And was there one episode of attack across the whole site, the outer ditch for example having been by then added to the original inner, or could we be seeing successive violent encounters? There are several factors to take into account. According to the model set out above, the inner ditch preceded the outer. We cannot claim to have dated the construction of the outer ditch as closely as that of the inner, however, since the few samples in question are exclusively residues on sherds, not short-life charcoals putatively from bank structure, as in the inner ditch. Strictly, the short-life charcoals from the inner ditch allow us to provide a date for construction of that earthwork, while the sherds from the burnt layer in the outer ditch provide us with an estimate of the destruction of the outer earthwork. Applying the same principle to the outer ditch, the residue samples from sherds there may also date destruction, not construction. The difference between inner ditch construction and outer ditch destruction according to the model is in the order of a couple of generations (Fig. 10.13: *gap ditches*), *35–80 years at 68% probability*. Other things being equal, that could allow a single, unified, sequence of events in which the earthworks were constructed, the inner perhaps before the outer, followed by a short period of use, and then destruction affecting both earthworks some two generations later. In that case, initiation of the enclosure would not have been closely linked to anticipation of imminent attack.

There is another factor to take into account. From Liddell’s sections and descriptions, it is evident that some primary fill had accumulated in both ditches before the burning episode or episodes took place. In two cases in the inner ditch (Liddell 1935, figs 5–6), ‘rapid’ silting had

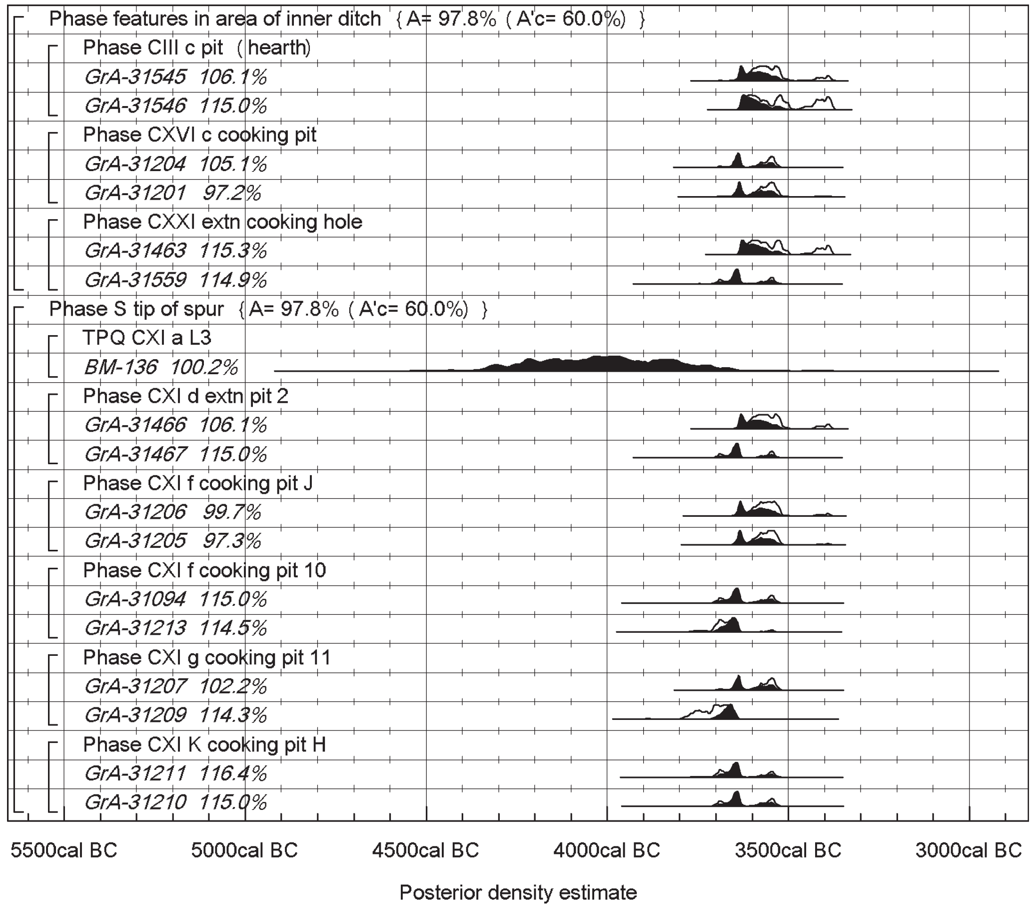


Fig. 10.11. Hembury. Probability distributions of dates from the Neolithic occupation areas. The format is identical to that of Fig. 10.8. The overall structure of this model is shown in Fig. 10.9, and its other components in Figs 10.10 and 10.12.

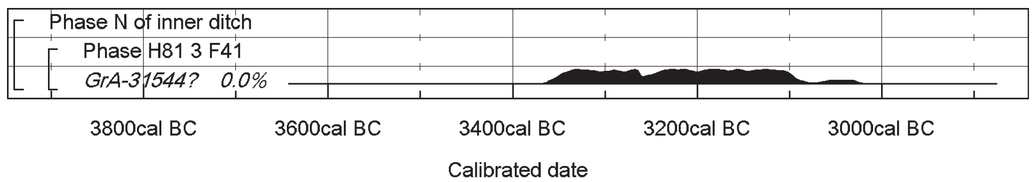


Fig. 10.12. Hembury. Probability distribution of the date from the potentially Neolithic feature between the Neolithic earthworks. For the reasons explained in the text, this date has not been included in the chronological model, but has been calibrated only (Stuiver and Reimer 1993). This is denoted by the question mark after the distribution name. The format is identical to that of Fig. 10.8. The overall structure of this model is shown in Fig. 10.9, and its other components in Figs 10.10–11.

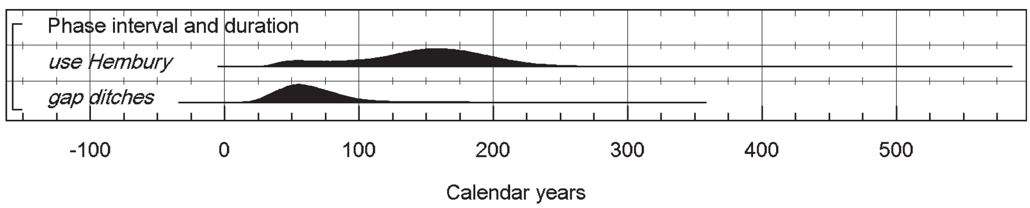


Fig. 10.13. Hembury. Probability distributions of the number of years between the construction of the ditches at Hembury and the duration of the use of the enclosure, derived from the model shown in Figs 10.9–12.

filled the corner angle of broad and deep ditch segments to a height of *c.* 0.75 m, but had barely covered the base of the ditches at their centres of silting. The same sort of relationship is reported for the outer ditch. Greensand weathers very quickly, at least as quickly as Chalk, and so these primary fills could conceivably be the product of just one or two seasons; they do not look like the outcome of a couple of generations. So, although the short-life

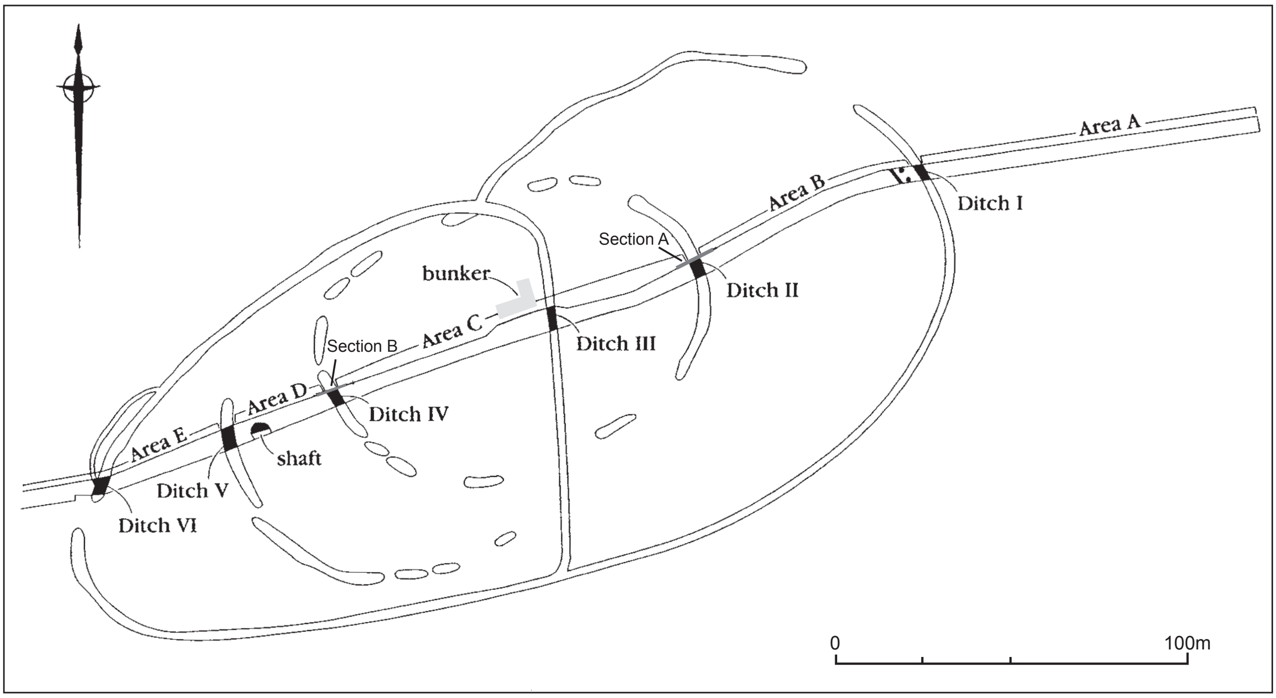


Fig. 10.14. Raddon. Plan showing extent of excavation. After Gent and Quinnell (1999b, fig. 3).

charcoal samples provide us with construction dates for the inner earthwork, the stratigraphic evidence suggests that the burning episode there should have followed very soon after construction. In that case, we have an argument for successive constructions and successive destructions, and one implication is that where the inner earthwork is concerned, and perhaps also the outer, construction could have been in anticipation of imminent attack (an argument on the basis of *post hoc ergo propter hoc*). For this reading, it should be noted that the sherds from the inner ditch from which residue samples were obtained are simply recorded as from spit 6, and so cannot decisively be assigned to the burning layer. We can see from the dates from the pits that activity continued at Hembury, and the inner ditch sherds in question could be part of that presence, post-dating the destruction of the earthwork.

Whatever the case, and as at Hambledon Hill (Chapter 4), attack was not followed by immediate abandonment of this place, since the ditch was recut after silts had accumulated over the burnt deposits, and the dates from the areas of occupation suggest continued activity on the site into the 36th century cal BC. The single date for the pit between the two enclosure ditches may also suggest some activity in the later fourth millennium cal BC.

10.3 Raddon Hill, Stockleigh Pomeroy, Devon, SU 8855 0315

Location and topography

Raddon Hill forms part of a ridge, overlooked by higher hills to the north and east, in the interfluve of the rivers Creedy (a small tributary of the Yeo) and Exe (Fig. 10.1; Gent and Quinnell 1999b, fig. 1). The enclosure surrounds the hilltop, at 205–14 m OD, without any obvious favoured orientation (Oswald *et al.* 2001, fig. 5.2). The ridge is formed of Cadbury Breccia, a Permian deposit, here a sandy clay matrix with fragments mainly of Carboniferous sandstone and shale. It consists of a complete ovoid inner circuit enclosing *c.* 0.6 ha, and an incomplete outer circuit on the south-west side only, enclosing a further *c.* 0.3 ha.

History of investigation

Although air photography had already shown that there was a multi-ditched enclosure on the hilltop (Griffith 1994, 72), the Neolithic elements were identified only in the course of geophysical survey and excavations undertaken in advance of the construction of an access road to a new reservoir (Fig. 10.14). The excavation was undertaken by the Exeter Museums Archaeological Field Unit (now Exeter Archaeology), the roadline providing a transect 3–4 m wide from east to west along the long axis of the enclosure, approximately bisecting it.

The inner ditch was sectioned as ditch II in the east and as ditch IV in the west. It was flat-bottomed in both sections, and up to 4 m wide and 0.80 m deep (Fig. 10.15). It seemed to have silted naturally, although in ditch IV the absence of primary silt and an irregular profile may suggest cleaning out. Slightly asymmetric fills gave some indication of an internal bank. In the west, context 611, a deposit particularly rich in charcoal and struck flint, had, however, entered the ditch from the exterior, as had the overlying layer (Gent and Quinnell 1999b, fig. 8).

The outer ditch was sectioned as ditch V. It too seemed

Table 10.2. Radiocarbon dates from Raddon, Devon. Posterior density estimates derive from the model defined in Fig. 10.16.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Inner ditch								
GrA-31190	RH94 573 B	Small Neolithic Bowl sherd in Quinnell's fabric VQVV with some internal residue. From different vessel to RH94 573 A	Area B, ditch II, F576, context 573. From layer in mid fill of ditch, stratified above 574 (Gent and Quinnell 1999b, fig. 8)	4675±35	−30.7		3630–3360	*3630–3575* (*23%*) or *3540–3395* (*71%*) or *3385–3370* (*1%*)
GrA-31189	RH94 573 A	1 out of 3 Neolithic Bowl sherds in Quinnell's fabric VQMV with fresh, well preserved internal residue. From different vessel to RH94 573 B	From the same context as GrA-31190	4760±40	−30.4		3650–3370	*3640–3495* (*90%*) or *3430–3380* (*5%*)
OxA-X-2165-10	RH94 574 A	2 joining Neolithic Bowl body sherds in Quinnell's fabric VQVV with internal residue. Replicate of GrA-31191. Certificate: 'This sample had a very low target current in the AMS which accounts for its higher standard error. The sample has been reported with an OxA-X- number, which we use for experimental measurements, rather than an OxA. The sample is reported in the hope that it might be useful in some respect rather than simply being a 'failed' analysis.'	Area B, ditch II, F576, context 574. From layer immediately above primary silt (Gent and Quinnell 1999b, fig. 8)	4950±300	−27.7	4813±40; T'=0.2; T'(5%)=3.8; ν=1	3660–3520	*3660–3525*
GrA-31191	RH94 574 B	2 joining Neolithic Bowl body sherds in Quinnell's fabric VQVV with internal residue. Replicate of OxA-X-2165-10	From the same context as OxA-X-2165-10	4810±40	−30.9			
AA-29723		*Corylus* charcoal	Area C, ditch IV, feature 612, layer 611. Charcoal-rich layer derived from exterior, overlying two layers of stony redeposited subsoil. Much struck flint, some Neolithic Bowl pottery, charred crab apple flesh (Gent and Quinnell 1999b, fig. 8)	4525±50	−24.2		3490–3020	
GrA-31309	RH94 611 B	Single fragment *Prunus* sp. charcoal	From the same context as AA-29723	4755±35	−25.4		3640–3370	*3640–3495*
GrA-31215	RH94 611 A	Single fragment Pomoideae charcoal	From the same context as AA-29723	4840±40	−25.7		3700–3520	*3695–3680* (*1%*) or *3675–3620* (*33%*) or *3605–3520* (*61%*)
Other contexts								
AA-29729		*Corylus* charcoal	Area C, feature 925, context 926. One of 2 parallel features, thought of as possible graves, within area enclosed by inner ditch. Uncertain if Neolithic, since the other dated to the sixth century AD. Contained 8 pieces of struck flint, 4 burnt bone fragments, charred grain, charcoal	4615±60	−26.1		3630–3110	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	δ^{13}C (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
AA-29721		Pomoideae/*Prunus* and *Salix*/*Alnus* charcoal	Area A, ditch I, context 552. From among stones overlying initial silt in ditch of Iron Age hillfort (Gent and Quinnell 1999b, fig. 8). Neolithic pottery in higher layer. No Iron Age finds. Rampart cut by IA post trench and, at least in spread state, overlay IA gully	4520±50	−24.7		3370–3020	

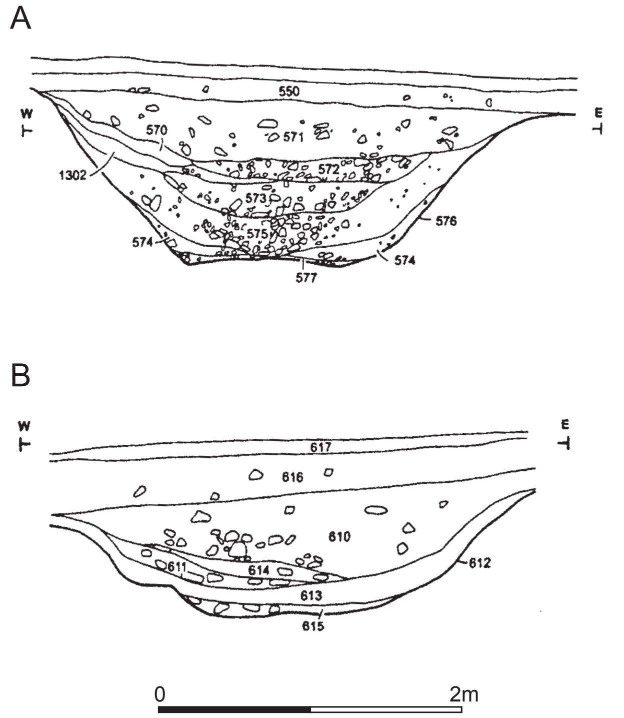


Fig. 10.15. Raddon. Sections of ditches II (A) and IV (B). After Gent and Quinnell (1999b, fig. 8).

to have silted naturally and to have had an internal bank. It was far poorer in finds than the inner ditch.

Neolithic activity extended beyond the two enclosure ditches. Neolithic pottery was found in an upper fill of an Iron Age ditch (ditch I) some 50 m east of the inner circuit, and a charcoal sample from a lower layer of the same ditch was dated to the last quarter of the fourth millennium cal BC (Table 10.2: AA-29721). Another charcoal sample from an internal feature dated to the second half of the fourth millennium cal BC (Table 10.2: AA-29729). Pits and postholes containing Neolithic material were found outside the outer ditch, but their date is uncertain, because the intensity of Iron Age, Romano-British and sub-Roman use of the hilltop makes redeposition probable (Gent and Quinnell 1999b, 65).

Pottery from the ditches and other contexts was Bowl in the South-Western style, in a wide range of fabrics among which gabbroic wares are scarce and those from more local fabrics abundant (Quinnell 1999). The struck flint seems mainly to have come from the Chalk (Tingle 1999). A soft greenstone axehead of unusual triangular outline from the outer ditch is of disputed origin, attributed to Group I or, tentatively, to a source in northern France by different petrologists (Quinnell and Taylor 1999).

Previous dating

Following the excavation, 16 radiocarbon determinations were obtained from the Scottish Universities Research and Reactor Centre, East Kilbride (Reed 1999, table 16). All were of charcoal recovered by wet-sieving of samples

in which carbonised plant remains were often poorly preserved and scarce or absent (R. Gale 1999), a fact which restricted the original dating programme. The majority of these samples were from Iron Age, Romano-British and sub-Roman contexts. One (Table 10.2: AA-29723) came from the charcoal-rich layer in the inner ditch described above, while two, although of Neolithic age, came from possibly or definitely post-Neolithic contexts (Table 10.2: AA-29729, -29721). All samples were pretreated and converted to graphite targets at the SUERC according to the methods outlined by Stenhouse and Baxter (1983) and Slota *et al*. (1987), and measured using AMS at the University of Arizona (Donahue *et al*. 1997).

Reassessment of existing dates

AA-29723, consisting of short-life charcoal, from context 611 in the inner ditch, was the only radiocarbon measurement on a sample from a coherent Neolithic deposit of burnt material. It should hence be close in age to its context. AA-29729 was equally measured on short-life charcoal, but this came from a context from which only 13 charcoal fragments were identified, as against 39 from context 611, the context of AA-29723 (R. Gale 1999, table 15), increasing the probability that the charcoal was redeposited in the fill of the feature. AA-29721 was measured on charcoal recovered from one of the lower fills of an Iron Age ditch (Gent and Quinnell 1999b, fig. 8, upper section: context 552). The presence of two taxa in the sample makes it possible that the sample combined Neolithic and later fragments. All three dates suggest Neolithic activity on the hill in the mid- to late fourth millennium cal BC, with AA-29723 providing a date for a fill overlying two layers of stony redeposited subsoil of 3490–3020 cal BC (95% confidence).

Objectives of the dating programme

The main aims were to refine the estimate for the use of the enclosure provided by AA-29723, to locate samples from other Neolithic contexts, especially in the outer ditch, and better to define the duration of Neolithic use of the hilltop.

Sampling strategy

The limited extent of the excavation and the fact that bone did not survive severely restricted the choice of samples, and no suitable material could be found from the outer ditch. Two further single-entity samples were dated from the context of AA-29723 (Fig. 10.16: *GrA-31309, -31215*) and a sequence from two successive layers in the inner ditch on the other side of the enclosure was made up of replicate measurements on carbonised residue from two joining sherds from a layer immediately above the initial silt (Fig. 10.16: *574 residue*) and of carbonised residue from two further vessels from a middle layer (Fig. 10.16: *GrA-31189, -31190*).

Results and calibration

Full details of all the radiocarbon measurements on potentially Neolithic material from the site are listed in Table 10.2.

Analysis and interpretation

The inner ditch. The three radiocarbon measurements from the charcoal-rich fill in the inner ditch (ditch IV) are statistically inconsistent (Fig. 10.16: GrA-31309, -31215, AA-29723; T'=24.5; T'(5%)=6.0; ν=2), the pre-existing measurement being significantly younger. This is puzzling since all three samples consisted of short-lived material from an apparently coherent dump of charred plant remains. The two samples measured as part of our dating programme (GrA-31215, -31309) were single fragments of charcoal. AA-29723 consisted of *Corylus* sp. but it is not clear whether this sample comprised more than one fragment; other samples previously submitted certainly did include more than one fragment as two or more species were identified (Reed 1999, table 16). Since the two determinations from Groningen are statistically consistent (T'=2.6; T'(5%)=3.8; ν=1), it seems most reasonable to suggest that AA-29723 comprised charcoal fragments of a range of ages (potentially, for example, including both Neolithic and Iron Age material, the latter therefore intrusive by some means or other). For this reason, it has been excluded from the model.

In the inner ditch (ditch II), a sequence of samples was dated (Fig. 10.16). Two statistically consistent measurements were obtained on carbonised residue from two joining sherds of Neolithic Bowl pottery (GrA-31191, OxA-X-2165-10; T'=0.2; T'(5%)=3.8; ν=1) from one of the lowest fills. The sample from this vessel dated at Oxford produced a very low target current in the accelerator, accounting for the large standard error. Two more dates (*GrA-31189–90*) were obtained from residue on two different vessels from a fill higher up this section (Fig. 10.16). Of these vessels, one was represented by a single sherd, and the other by three sherds.

The outer ditch. No samples were available from the outer ditch. Two Neolithic dates were obtained from other, probably more recent, contexts (Fig. 10.16). AA-29721 was a bulk sample of mixed short-lived charcoal species, from an Iron Age ditch (ditch I). This sample may also have comprised material of diverse ages and so has been excluded from the model. AA-29729 was a sample of *Corylus* sp. from one of a pair of aligned features interpreted as possible graves. The charcoal in this feature was sparse and poorly preserved, and any interpretation of its taphonomy must be tentative. Again we do not know whether the sample consisted of more than one fragment of charcoal, and so, for the sake of caution, it has also been excluded from the model. It should be noted that this material was probably residual in this context since the other possible grave produced a date of cal AD 550–690 (AA-29726; 1405±55 BP).

The model shown in Fig. 10.16 suggests that the inner

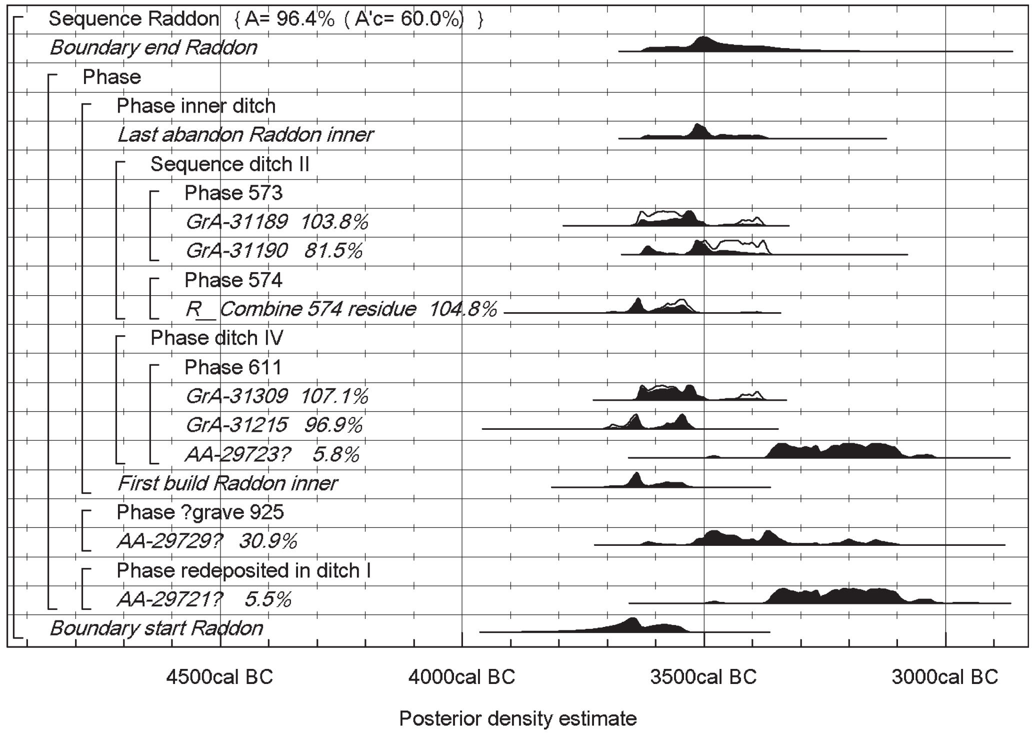


Fig. 10.16. Raddon. Probability distributions of radiocarbon dates. The format is the same as for Figs 10.8 and 10.12. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

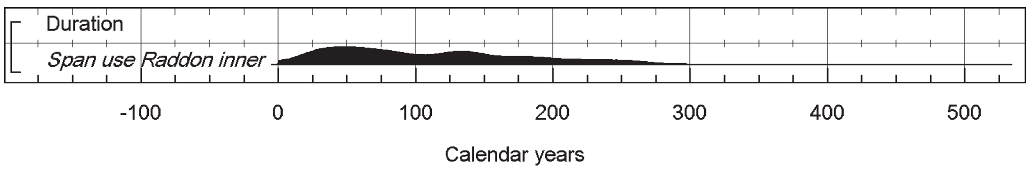


Fig. 10.17. Raddon. Probability distribution of the number of years during which the enclosure was in primary use, derived from the model shown in Fig. 10.16.

circuit at Raddon was constructed in *3695–3680 cal BC* (*2% probability*; Fig. 10.16: *build Raddon inner*) or *3670–3535 cal BC* (*93% probability*), probably in *3655–3625 cal BC* (*41% probability*) or *3585–3545 cal BC* (*27% probability*). The enclosure was in primary use until *3625–3545 cal BC* (*20% probability*; Fig. 10.16: *abandon Raddon inner*) or *3540–3375 cal BC* (*75% probability*), probably until *3620–3610 cal BC* (*2% probability*) or *3535–3480 cal BC* (*43% probability*) or *3475–3440 cal BC* (*10% probability*) or *3435–3380 cal BC* (*13% probability*). Overall, the enclosure was in primary use for *1–250 years* (*95% probability*; Fig. 10.17: *use Raddon inner*), probably for *15–155 years* (*68% probability*). This is a minimum estimate, since substantial assemblages of Neolithic pottery and struck flint came from context 572, which overlay 573, the context of GrA-31189 and -31190 (Quinnell 1999, table 5; Tingle 1999, 36), suggesting that the site continued to be frequented for a while longer.

Implications for the site

Raddon is the most westerly causewayed enclosure known so far (Oswald *et al*. 2001, fig. 5.8). At Bury Down near Lanreath, east of the Fowey estuary in Cornwall, a discontinuous ditch circuit surrounding an Iron Age fort has been mooted as a possible causewayed enclosure (and see also Barcelona High Field, Pelynt, noted above). Trial excavations in 1994 found a V-shaped ditch profile and no artefacts, and the ditch may well simply be an unfinished part of the hillfort (Oswald *et al*. 2001, 87; Ray 1998; 2001). That Raddon belongs to the 37th or 36th century cal BC therefore has more than local significance.

10.4 Helman Tor, Lanlivery, Cornwall, SX 0618 6164

Location and topography

Helman Tor lies at 205 m OD on a granite outlier south-west of Bodmin Moor (Fig. 10.1). The site occupies the tip of a spur, 'tilted' to the south-west (Oswald *et al.* 2001, fig. 5.7). It is defined by a boulder-built wall joining granite outcrops, potentially enclosing an area *c.*180 m from north to south by 40 m from east to west, with a possible entrance

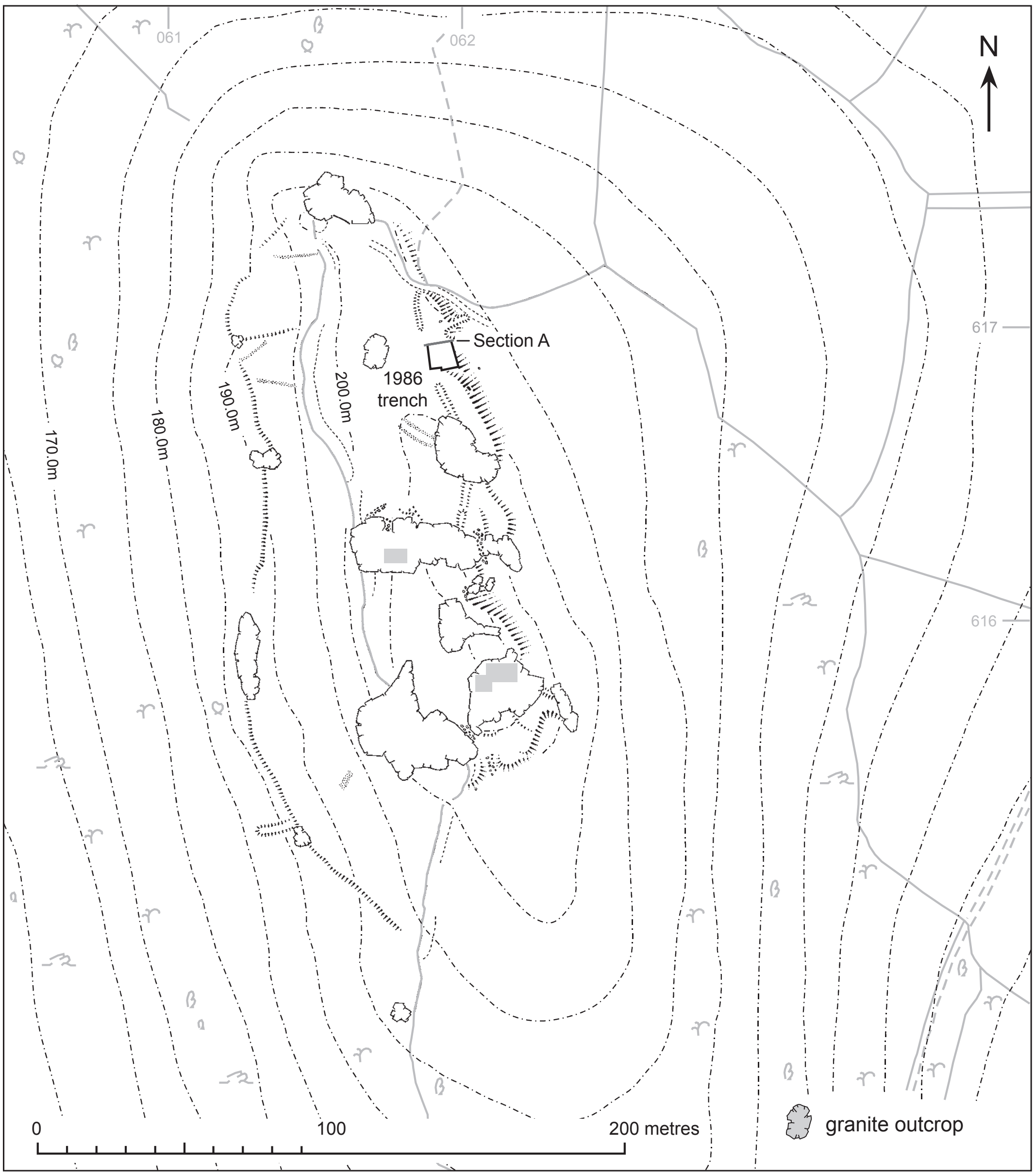


Fig. 10.18. Helman Tor. Survey showing location of 1986 excavation. After Mercer (1997, fig. 2) and Oswald et al. *(2001, fig. 5.7).*

to the south. The full extent of walling on the west side of the hill has not been established, although an undated early wall underlies a demonstrably recent one along that part of the summit not defined by steep granite ledges (Fig. 10.18; Mercer 1997, 9–11). Small sub-rectangular platforms, some of them partly defined by walling, are dispersed over the interior (Fig. 10.18). There is a possible outer enclosure to the west, and field systems of unknown date cover the flanks of the hill (Mercer 1997).

History of investigation

The recognition that a boulder-built enclosure on Carn Brea, in west Cornwall (see Chapter 10.5), was of Neolithic date prompted a search for other sites of similar character (Mercer 1981a, 189–90). Helman Tor was one of the most closely comparable, the similarity emphasised by a survey conducted in the early 1980s (Johnson and Rose 1984). Following a decision to promote public access to the site, English Heritage commissioned an evaluation in order to determine the date, nature and cultural affiliation of the enclosure. This was carried out in 1986 by a team from Edinburgh University, directed by Roger Mercer (1997).

A single 9 m by 10 m trench was cut across one of the platforms and the boulder wall against which it abutted (Fig. 10.19). A linear hollow some 0.50 m deep immediately behind the wall contained successive layers rich in Neolithic artefacts, apparently tipped into it against the base of the wall. In other words, material in the base of the hollow should date from very soon after the building of the wall, especially as the sherds from it were large and fresh, and included a virtually complete vessel from the bottom (Mercer 1997, pl. 6). Tumble from the wall was sporadic through the fills of the hollow and covered the

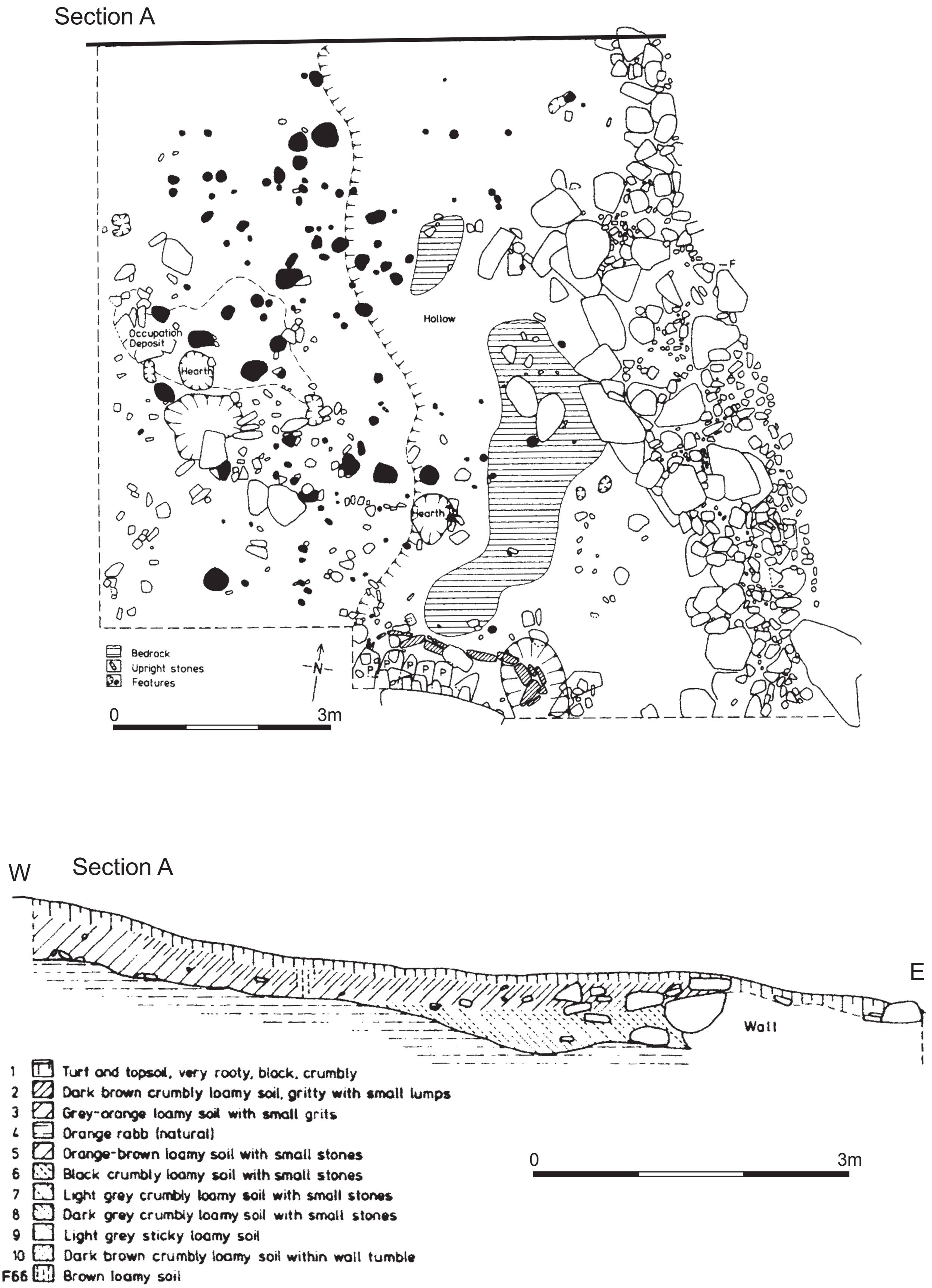


Fig. 10.19. Helman Tor. Plan and section of the 1986 excavation. After Mercer (1997, figs 3, 4).

Table 10.3. Radiocarbon dates from Helman Tor, Cornwall. Posterior density estimates derive from the model defined in Fig. 10.22.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Hollow								
GrA-31319	HT86 697 A	Sherd from rounded base of virtually complete Bowl (I. Smith 1997, P14), with internal residue towards bottom	F164 (original, in-field no.). Vessel found virtually complete at the base of a hollow immediately behind the boulder wall, impacted into the natural rabb, stratified below samples for HAR-8822–3, some sherds of the same vessel found in overlying fill (Mercer 1997, 16, pl. 6). The vessel would have entered (been thrown?) into the hollow before any material had accumulated against the rear of the wall, i.e. very soon after the wall was built	4705±35	−30.0	4783±24 T'=9.2; T'(5%)=3.8; ν=1	3640–3520	*3650–3615* (*51%*) or *3610–3545* (*44%*)
OxA-15631	HT86 697 B	Replicate of GrA-31319	From the same context GrA-31319	4851±33	−26.6			
HAR-8819	HT86 L6 (18 bags: HT86 111, 225, 286, 289, 291, 297, 300, 302, 305, 313, 314, 317, 320, 346, 368, 452, 463, 480)	Remainder subsequently identified as *Quercus* sp. heartwood and sapwood — large fragments, fast grown and probably from wide roundwood, *Corylus* sp., *Prunus spinosa,* Pomoideae and unidentified	L6. Charcoal dispersed in topmost level of hollow behind boulder wall, interpreted as a trampled surface (Mercer 1997, 16–19)	4520±60	−26.8		3490–3020	
HAR-8822	HT86 103 A (1 bag: HT86 646)	Remainder subsequently identified as *Corylus* sp., *Quercus* sp. heartwood , *Prunus spinosa* and unidentified	F103. Hearth with *in situ* burning, cut into L6, topmost fill of hollow behind boulder wall. Stratified above HT86 697. The measurement quoted here is that given by Walker *et al.* (1991), which is slightly different from that given by Mercer (1997, 21)	4780±70	−26.7		3700–3370	
HAR-8823	HT86 103 B	Remainder subsequently identified as *Corylus* sp. (fast-grown) and unidentified	From same context as sample for HAR-8822	4570±70	−27.9		3520–3020	
GrA-31312	HT86 103 C (2 bags: HT86 574, 575)	Single fragment of *Corylus* charcoal	From same context as sample for HAR-8822	4745±35	−27.1		3640–3370	*3635–3505*
GrA-31314	HT86 103 D	Single fragment of *Quercus* sapwood charcoal	From same context as sample for HAR-8822	4865±40	−25.2		3710–3530	*3645–3625* (*9%*) or *3600–3525* (*86%*)
Other features								
HAR-8818	HT86 59 (2 bags: HT86 521, 645)	Remainder subsequently identified as *Quercus* sp. heartwood and sapwood, *Corylus* sp., *Alnus* sp. and unidentified	F59. Dense charcoal in slim post socket in surface of L4 (natural rabb) close to hearth F60 (Mercer 1997, fig. 5)	4880±120	−28.9		3960–3370	*3765–3510*
GrA-31310	HT86 59 A	Single fragment of *Corylus* charcoal	From the same context as HAR-8818	4925±35	−27.2		3790–3640	*3750–3640*
GrA-31311	HT86 59 B	Single fragment of *Alnus* charcoal	From the same context as HAR-8818	4930±35	−27.1		3790–3640	*3750–3640*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
HAR-8820	HT86 60 A (1 bag: H86 641)	Remainder subsequently identified as *Corylus* sp., *Alnus* sp. and unidentified	F60. 'Densely packed charcoal' from hearth with *in situ* burning, associated with remnant occupation deposit on L4 (natural rabb) to W of hollow (Mercer 1997, 21–2)	4490±70	−27.9		3490–2910	
HAR-8821	HT86 60 B (5 bags: HT86 522, 614, 626, 656, 657)	Remainder subsequently identified as *Corylus* sp., *Alnus* sp. and unidentified	From the same context as HAR-8820	4240±70	−28.5		3020–2620	
GrA-31315	HT86 60 B	Fragment of *Corylus* charcoal	From the same context as HAR-8820	4745±35	−25.1		3640–3370	*3640–3515*
GrA-31316	HT86 60 C	Fragment of *Corylus* charcoal	From the same context as HAR-8820	4785±35	−26.0		3650–3380	*3645–3520*

topmost fill (Mercer 1997, figs 3–4). The fills of the hollow were cut by a few stakeholes and, at its inner edge, by a hearth, F103, which consisted of a pit with signs of *in situ* burning and much charcoal. At the extreme southern edge of the excavation was a very small structure with a paved floor, 2.5 m by 0.75 m, formed by a wall defining the edge of the platform and a slot in which granite slabs were set on edge, possibly to support wooden uprights. West of the hollow and in no definite stratigraphic relation to it were F60, a hearth similar to F103, and a plethora of post- and stakeholes, from which structural plans could be teased only with difficulty and which were interpreted as reflecting repeated replacement and rebuilding of shelters.

Despite the small area excavated, the site was rich in artefacts, most of them from the upper fill of the hollow. Almost a hundred vessels in the South-Western style were represented, about a quarter of them in gabbroic fabrics, the rest from more local sources (I. Smith 1997; Williams 1997). The lithics included flint from the Chalk as well as from less distant sources, and were uniformly early Neolithic in character (Saville 1997); two fragmentary axeheads of Group XVII greenstone were found during the excavation, surface finds of a Group I axehead and a further Group XVII axehead having already been made on the flanks of the hill (Roe 1997).

Previous dating

Six bulk charcoal samples (Table 10.3: HAR-8818–23) were submitted to the Isotope Measurements Laboratory, Harwell, following the excavation (A. Walker *et al.* 1991, 109), and were processed as described by Mook and Waterbolk (1985) and dated as described by Otlet and Warchal (1978), Otlet (1979) and Otlet and Polach (1990). All were described as 'small wood' (Mercer 1997, 21) and all may have included material of various ages, although it is worth noting that the remaining material from HAR-8818–19 and -8822 was subsequently found to include oak heartwood, while that from HAR-8820 and -8823 included only short-lived and unidentified material. There were also taphonomic differences between the samples; HAR-8819 was composed of fragments dispersed through the topmost fill of the hollow, while the others came from discrete features. In the case of HAR-8818 the charcoal was densely packed in a post socket, although the subsequent identification of three species among the remaining material (Table 10.3) indicates that it was not a burnt post.

Mercer found the results problematic (1997, 21–3). The discrepancy between HAR-8820 and -8821, measured on samples from the same hearth (F60), prompted the conclusion that the later of the two dates should perhaps be accepted, with implications for an extended local persistence of Neolithic traditions. The two measurements are not statistically consistent (T'=6.4; T'(5%)=3.8; ν=1); this may be due to the heterogeneity of the samples and/or to the location of the feature on a perhaps long exposed and long used surface. The greatest problem, however, was the relationship between HAR-8819, measured on dispersed charcoal from L6, the top fill of the hollow, and HAR-8822

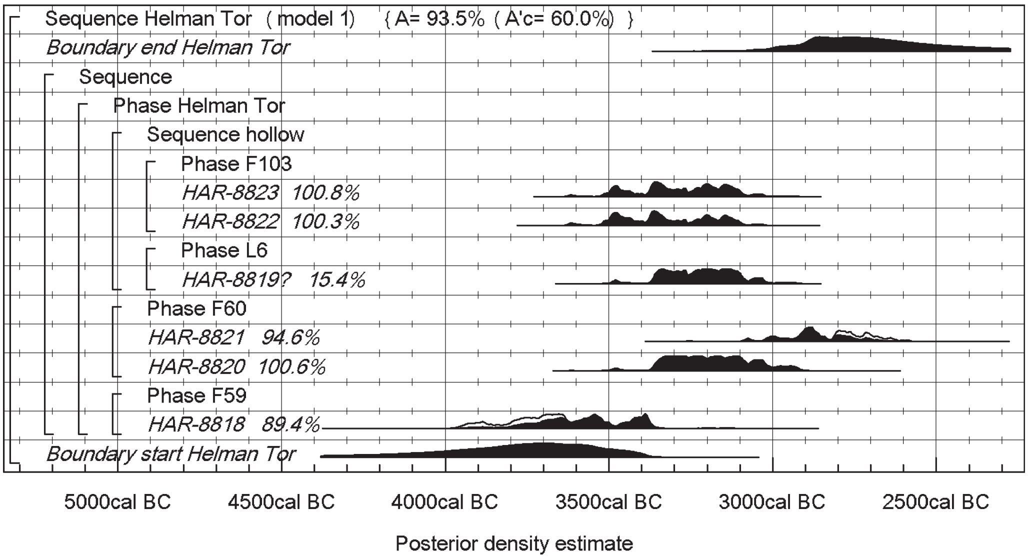


Fig. 10.20. Helman Tor. Probability distributions of radiocarbon dates available in 1997 (model 1). The format is the same as for Figs 10.8 and 10.12. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

and -8823 from F103, a hearth cut into it. These too are statistically inconsistent (T'=9.9; T'(5%)=6; ν=2), HAR-8819 being more recent than the two measurements from the stratigraphically later feature. Mercer arrived at the plausible interpretation that material had continued to be trampled into the surface of L6 after F103 had been cut into it. This left HAR-8822 and -8823 as providing a *terminus ante quem* for the construction of the wall (1997, 23), and all the dates together as providing a span of 3300–2700 cal BC for latest occupation of the site (Mercer 1997, 23).

Objectives of the dating programme

The main aims were to confirm and refine the estimates for the construction date and the span of use of the site.

Sampling strategy and simulation

The small scale of the excavation provided a limited pool of potential samples. Internal carbonised residue from the semi-complete pot at the base of the hollow behind the wall provided replicate samples at the start of the sequence. Otherwise, single-entity short-life samples were selected from the material remaining from the samples dated at Harwell, except for the dispersed material surviving from HAR-8819.

Results and calibration

Full details of all the radiocarbon measurements are given in Table 10.3.

Analysis and interpretation

Three alternative models for the chronology of Helman Tor are presented in Figs 10.20–22.

Model 1 (Fig. 10.20) integrates the archaeological sequence with the results from bulk charcoal samples available in 1997. Following Mercer (1997, 22), HAR-8819 is excluded from the model, being interpreted as deriving from trampled material of mixed age. This model has good overall agreement ($A_{overall}$=93.5%), and suggests that occupation on the site continued from the early fourth to the early third millennia cal BC.

Figure 10.21 (model 2) integrates the new radiocarbon measurements obtained as part of this programme with the existing results on bulk charcoal samples. This model also has good overall agreement ($A_{overall}$=62.6%), although the results on bulk charcoal samples are consistently younger than those obtained from single fragments of charcoal from the same deposits. For example, in hearth F60 the two single-entity samples produced statistically consistent measurements (GrA-31315–6; T'=0.7; T'(5%)=3.8; ν=1), although the measurements on the two bulk charcoal samples are significantly different, both from each other (HAR-8820–1; T'=6.4; T'(5%)=3.8; ν=1) and from the measurements on the single entities (T'=57.0; T'(5%)=7.8; ν=3).

For this reason, a third model was constructed (Fig. 10.22). In this model, only HAR-8818 from the existing measurements is considered reliable. The undated residue of this sample was retrospectively identified as *Quercus* sp. heartwood and sapwood, *Corylus* sp. and *Alnus* sp. Despite the inclusion of material with some age offset in this sample, the measurement is statistically consistent with dates recently obtained on single-entity samples from the same deposit (GrA-31310–1, HAR-8818; T'=0.2; T'(5%)=6.0; ν=2). The measurements from hearth F60 have been discussed above, and in this model HAR-8820–1 are interpreted as including charcoal fragments from later activity on the hilltop.

In the hollow, replicate measurements on two samples from the vessel at its base (GrA-31319, OxA-15631;

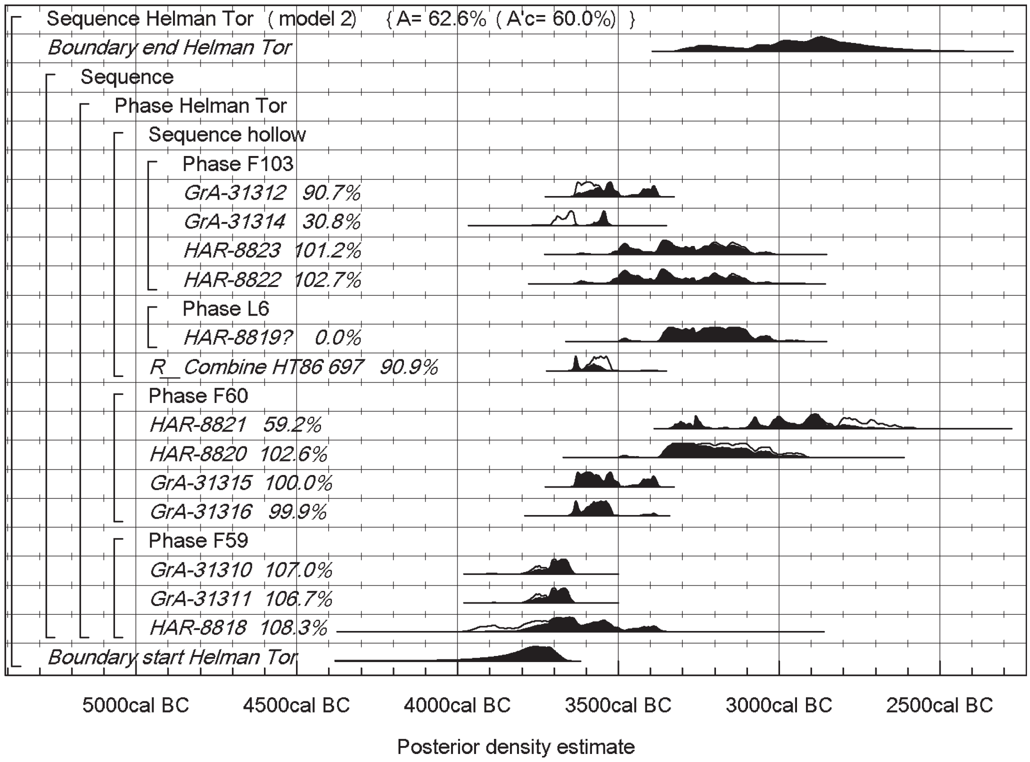


Fig. 10.21. Helman Tor. Probability distributions of radiocarbon dates (model 2). The format is the same as for Figs 10.8 and 10.12. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

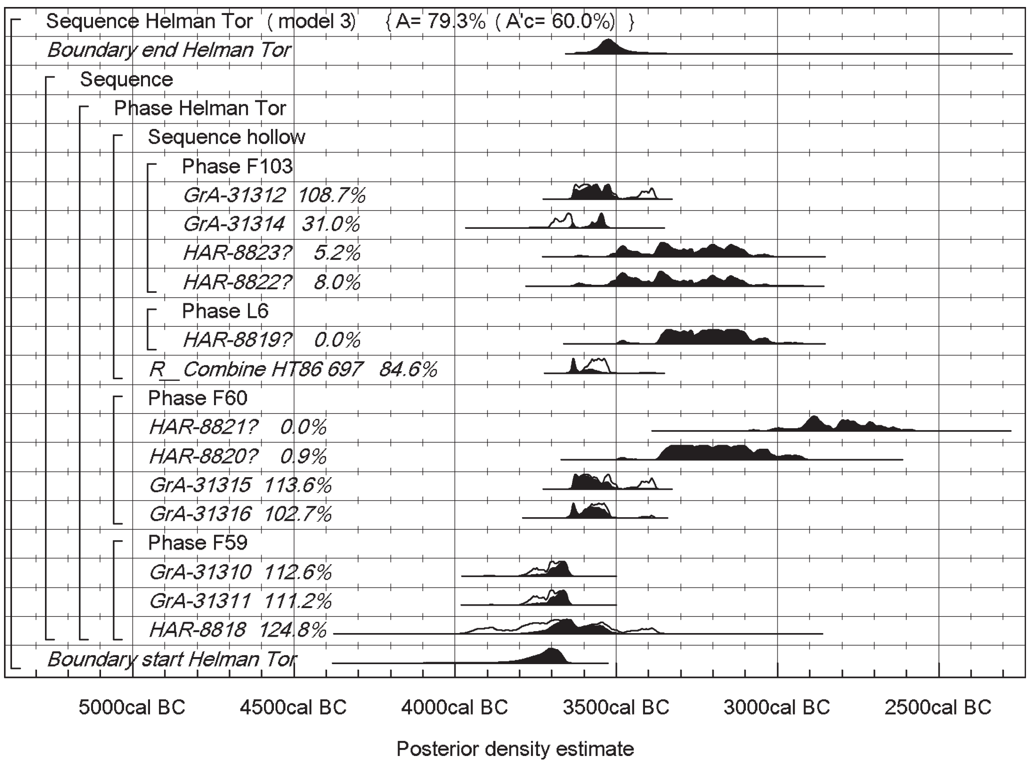


Fig. 10.22. Helman Tor. Probability distributions of radiocarbon dates (model 3). The format is the same as for Figs 10.8 and 10.12. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

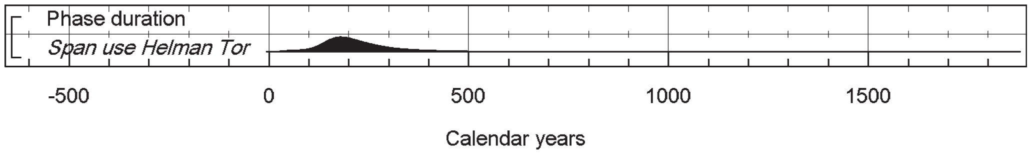


Fig. 10.23. Helman Tor. Probability distribution of the number of years during which the enclosure was in primary use, derived from the model shown in Fig. 10.22.

Fig. 10.22: *HT86 697*; Mercer 1997, plate 6, fig. 7) are statistically inconsistent (T'=9.2; T'(5%)=3.8; ν=1). They are nonetheless in good agreement with the stratigraphic sequence and so a weighted mean has been taken before calibration. HAR-8819 has been excluded from the model for the reasons already adduced by Mercer. The two single-entity samples stratified above it, from hearth F103 (*GrA-31312, -31314*), are statistically inconsistent with each other (T'=5.1; T'(5%)=3.8; ν=1) and with the two bulk samples (HAR-8822–3) from the same context (T'=19.9; T'(5%)=7.8; ν=3). The bulk charcoal samples are significantly later and so are again excluded from the model and interpreted as containing charcoal fragments of later date.

The surface into which these features were cut may have been exposed for some time after the features were formed, permitting the introduction of later material into these deposits. The results on the bulk charcoal samples, although falling in the later fourth millennium cal BC, do not necessarily indicate activity of that date, since the samples may have included charcoal of diverse age.

For these reasons, we prefer the third model, shown in Fig. 10.22. This suggests that the Neolithic activity at Helman Tor began in *3845–3650 cal BC* (*95% probability*; Fig. 10.22: *start Helman Tor*), probably in *3750–3665 cal BC* (*68% probability*). Occupation ended in *3630–3380 cal BC* (*95% probability*; Fig. 10.22: *end Helman Tor*), probably in *3565–3480 cal BC* (*68% probability*).

The difference between these date estimates suggests that the enclosure on Helman Tor was in primary use for *45–420 years* (*95% probability*; Fig. 10.23: *use Helman Tor*), probably for *125–275 years* (*68% probability*).

Implications for the site

The chronology presented here is not entirely satisfactory, although the model suggests that the Helman Tor enclosure was slightly earlier than and may have been in use for a shorter period than was previously estimated (Mercer 1997). The shape of the distribution for the parameter *start Helman Tor* given in Fig. 10.22 may suggest that it was constructed *c.* 3700 cal BC. We will compare this in more detail with other dated south-western sites below, but we can note here that there is no evidence that tor enclosures were any later than the ditched enclosures to the east. The dating presented here has not engaged with the question of the possible outer enclosure, as this was not excavated (Mercer 1997, 12). A comparable possible outer enclosure at Carn Brea is discussed more extensively in the next section.

10.5 Carn Brea, Kerrier, Cornwall, SW 6850 0760

Location and topography

Carn Brea is a granite spur rising to 228 m OD, steep to the north and gently sloping to the south. It commands views of the coast to the north and west and of the tors of Bodmin Moor to the east (Fig. 10.1). On the east summit a boulder-built wall links granite outcrops to enclose *c.* 0.7 ha, within which there are level platforms and terraces, often defined by low walling. The combined circuit of walls and outcrops is continuous but for a probable entrance (now damaged) in the south-west (Mercer 1981a, 17–19). The higher central summit of the hill, set to the west, is enclosed by ramparts, defined as Rampart 2 and the continuation of Rampart IN. The east and central summits are linked by boulder-built ramparts, defined as Ramparts IN and IS, together with Rampart 5, augmented at least in part by ditches on its southern side, and enclosing *c.* 2.8 ha. A further, outer circuit of ramparts, much interrupted by mine workings on its southern side, is defined by Ramparts 3, 6 and 4, enclosing an area of *c.* 14 ha. Rampart 3 is 'altogether far more massive', comprising a dump bank and massive ditch (Mercer 1981a, 9). A series of hut circles lie between the summits (Fig. 10.24).

History of investigation

The ramparts enclosing the two summits have long been known, and, in the twentieth century at least, have been interpreted as a multi-phase Iron Age hillfort. A hoard of Iron Age coins was found on the hill in the eighteenth century, as were Roman coins and a late Bronze Age metalwork hoard. Nineteenth-century excavators, however, recovered large quantities of Neolithic material, especially from the eastern summit, suggesting that this might be a focus of earlier settlement (Mercer 1981a, 9–12, 13–16).

These considerations led to research excavations from 1970 to 1973 directed by Roger Mercer on behalf of the Cornwall Archaeological Society (Mercer 1981a). The main aims of the project were to date the hut circles on the saddle between the eastern and central summits; to establish the limits and nature of Neolithic activity on the hill, especially on the eastern summit; to date the massive stone wall enclosing that summit; to examine one or more of the terraces within that wall; and to investigate the date and nature of the ramparts linking the two summits.

Approximately 10% of the available area of the eastern summit was excavated, and the ramparts linking the summits were sectioned to the south (Rampart IS in sites

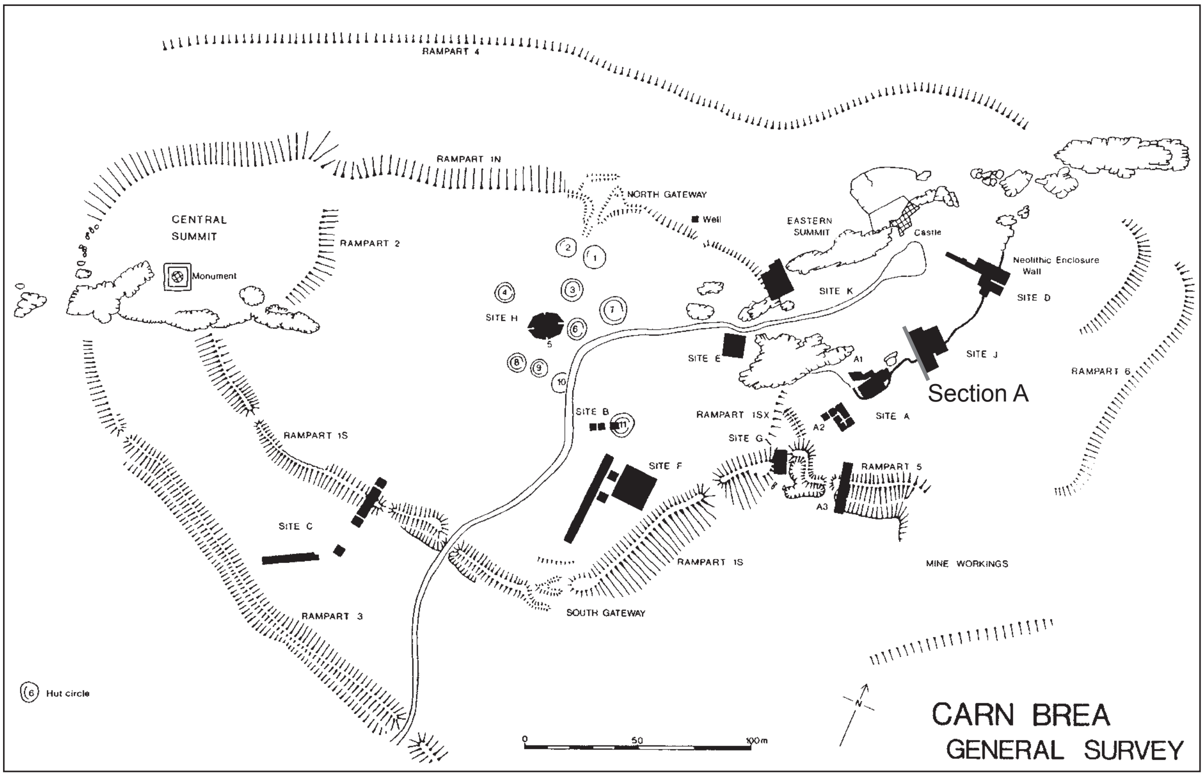


Fig. 10.24. Carn Brea. Plan showing extent of excavation. After Mercer (1981a, fig. 2).

C and G, and Rampart 5 in site A3). Cuttings were also made in areas between the summits (sites B and H over roundhouses, and site F), and between Ramparts IS and 3 (the extension of site C). No excavation was undertaken on the central summit, the northern inner rampart (IN) or on the outer circuit of ramparts (Ramparts 3, 4 and 6; Fig. 10.24).

The wall of the tor enclosure surrounding the eastern summit would have been some 2 m wide and up to 2 m high and was fronted by a shallow ditch for part of its length. It was of Neolithic date on the evidence of solely Neolithic artefacts, including pottery in fresh condition – in the sockets in which its facing slabs were set, in the body of the wall itself, and on the surfaces on to which its stones had collapsed – and of the radiocarbon dates discussed below. This enclosure was used, on the evidence of pits, postholes and hearths on the platforms and terraces and of a large artefact assemblage, some occupation preceding the construction of the wall on stratigraphic grounds. Occupation evidence beyond the wall was slighter, although present. The enclosure was also defensive and had been the subject of attack on the evidence of some 750 leaf arrowheads and of extensive burning.

Exploration of the southern rampart linking the two summits, although restricted (Fig. 10.24), prompted the conclusion that it was of Neolithic date. On site A3, only Neolithic material was present in the primary levels of the ditch, Iron Age pottery occurring at a much higher level; a Neolithic stone implement was found in the socket of an orthostat; and Neolithic occupation behind the rampart was undisturbed by its construction. On site G, sherds from three Neolithic vessels were found in the socket of one of the orthostats of a gateway. On site C, a narrow entrance lined by upright slabs was without artefacts other than Neolithic lithics. This evidence suggests a second, outer Neolithic enclosure, and thus also begs the question of the date of the ramparts around the central summit. The outer circuit of ramparts is currently unexcavated. There is Iron Age activity on the hill, and this circuit could be associated with it, but on the other hand its scale is not much greater than that seen in the Stepleton outworks at Hambledon Hill (Table 14.1).

The substantial assemblages from the site include fragments of 550 South-Western style vessels in gabbroic fabrics (I. Smith 1981). The lithics include a significant proportion of Chalk flint as well as flint and chert from more local sources. There is evidence for a minimal Mesolithic and Early Bronze Age presence (Saville 1981). Stone implements from the excavations and earlier surface finds include at least 38 whole or fragmentary axeheads, mainly of Group XVI, which is attributed to a local source, but also including Groups I, IV and XVII as well as ungrouped south-western greenstones and two ungrouped tuffs, possibly from Cumbrian or Welsh sources (I. Smith 1981).

Previous dating

Following the excavation, three bulk charcoal samples were submitted to the British Museum, and were prepared and dated as described by H. Barker *et al.* (1971) and Burleigh *et al.* (1976). Two (Table 10.4: BM-824–5) relate to the

Table 10.4. Radiocarbon dates from Carn Brea, Cornwall. Posterior density estimates derive from the model defined in Fig. 10.25.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Eastern summit								
BM-823	CB71 sample 47	Unidentified bulk charcoal sample	Site A2, F16 (originally F6). Scoop containing South-western style Bowl pottery and blocks of charcoal, outside enclosure wall and (Mercer 1981, fig.18). The measurement used here is that published by Burleigh *et al.* (1976, 37), rather than that quoted by Mercer (1981a, 37)	4561±47			3500–3090	*3520–3420* (*53%*) or *3380–3260* (*38%*) or *3240–3180* (*4%*)
BM-825	CB71 sample 92	'Block charcoal (oak)' (Mercer 1981a, 42)	Site D, F63 (originally F60). Posthole of apparent burnt structure visible in surface of 'occupation layer' L4 behind enclosure wall and beneath stone collapsed from it or from another stone-built feature (Mercer 1981a, 41–3, figs 10, 11). Originally F57	4999±64			3960–3640	*3950–3655*
BM-824	CB71 samples 70, 82, 95, 104, 113	'Charcoals from the deposit associated with the vessel' (Mercer 1981, 62)	Site E, L4. Surface inside enclosure wall, beneath stones from its collapse. Associated with a crushed South-Western style Bowl in fresh condition (Mercer 1981a, fig. 33; I. Smith 1981, fig. 66: P1)	4697±60			3640–3350	*3635–3550* (*30%*) or *3540–3370* (*65%*)
OxA-15634	CB73 1082 B	Body sherd from fine Neolithic Bowl, with well preserved internal residue.	Site J, area 4 ext, F17 (F20 in field). Fill of linear hollow immediately behind enclosure wall and sealed by its collapse (Mercer 1981a, 45, figs 23–4). It is not clear from which layer of the fill the sherd came	4781±31	−26.0		3650–3510	*3640–3510* (*93%*) or *3400–3380* (*2%*)
OxA-15705	CB73 1215	Fine Bowl rim sherd with slight internal and external residue. Certificate reads 'OxA-150705 produced a very low combustion yield. We burnt 9.79 mgs initially, producing 240 µg C, we then increased the burnweight to 22.7 mgs and obtained 328 µg C which is the carbon furnishing this result. This suggests some variability in the composition of the pretreated pot residue, as one might expect, but is also rather small compared with other residue analyses we have undertaken in this series. The sample therefore has a health warning attached to it.'	Site J, area 4a/5, F17 south (F20 in field), L3, upper black/brown. Fill of linear hollow immediately behind enclosure wall and sealed by its collapse (Mercer 1981a, 45, figs 23–4)	4725±45	−28.8		3640–3370	*3630–3490* (*61%*) or *3470–3375* (*34%*)
GrA-31195	CB73 1154	Large, well preserved Neolithic Bowl rim sherd with some internal residue (I. Smith 1981, fig. 73, P128)	Site J, area 4 ext, F17 (F20 in field), section 2, spit 2 dark. Fill of linear hollow immediately behind enclosure wall and sealed by its collapse (Mercer 1981a, 45, figs 23–4)	4605±35	−28.8		3500–3190	*3515–3425* (*72%*) or *3380–3335* (*23%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Rampart 5								
GrA-31194	CB71 2745 A	1 of 2 joining Neolithic Bowl body sherds with internal residue. Replicate of OxA-15632, -15633	Site A3, F37 (in original records), L1. 'Elongated subcircular feature up against N–S section — truncated by section. Charcoal spread' (A. Saville's feature sheet). This seems to correspond to one of two charcoal spreads behind the rampart (Mercer 1981a, 93, fig. 44). The survival of the spreads suggests that they had not been in place long before the inward collapse on to them of the wall	4525±35	−27.6			
OxA-15632	CB71 2745 B	1 of 2 joining Neolithic Bowl body sherds with internal residue, replicate of GrA-31194, OxA-15633	From the same context as GrA-31194	4746±34	−26.0	4769±24 T'=0.9; T'(5%)=3.8; ν=1	3640–3515	*3640–3515*
OxA-15633	CB71 2745 B	1 of 2 joining Neolithic Bowl body sherds with internal residue, replicate of GrA-31194, OxA-15632	From the same context as GrA-31194	4791±33	−25.5			

enclosure on the eastern summit. BM-824, from site E, was measured on a bulk charcoal sample from a greasy, brown, grit-free layer immediately underlying tumble from the enclosure wall. The charcoal was associated with a complete gabbroic Bowl in fresh condition (I. Smith 1981, fig. 66: P1) crushed beneath a fallen facing slab. Since the charcoal was unidentified and bulked, it provides a *terminus post quem* for the collapse.

BM-825, from site D, was measured on a sample described as 'block charcoal (oak)' and is thus likely to be older than its context. It was the stump of a post burnt *in situ*, as were the other posts and stakes of a putative structure, for which it provides a *terminus post quem*. Its relation to the wall is less clear. The boulders overlying the structure may have collapsed from another stone-built feature rather than the wall itself, since there was a gap between them and tumble clearly derived from the wall. The structure, however, seemed to respect the wall, and thus to have been built after it was in place. For this reason it was taken as providing a *terminus ante quem* for the building of the wall (Mercer 1981a, 41–3, figs 10, 11). The potential age offset makes this interpretation dubious.

BM-823, from site A2 immediately outside the enclosure, was measured on a sample from a feature described as containing 'blocks of charcoal', which suggests that the sample included material from substantial timbers. The feature also contained Neolithic pottery in fresh condition. The date provides a *terminus post quem* for the feature.

Objectives of the dating programme

The project aimed to refine the very approximate chronology for the tor enclosure on the eastern summit provided by the existing dates and to date the excavated parts of the inner ramparts linking the summits.

Sampling strategy and simulation

The limitations are eloquently described by Mercer (1981a, 16): 'Soils on the site are extremely acid in composition and abrasive in texture. . . . No bone would survive on the site, charcoals would commonly be commuted to smears or dust unless well protected, no mollusc shells would survive'. Furthermore, there had been no sieving for charred plant remains and no charcoal remained from the original dates. Available samples were thus reduced to carbonised residues on pottery. A sample of the black coating noted on the exterior of several vessels (I. Smith 1981, 170–2) was examined by Ian Freestone of Cardiff University and found by Raman spectroscopy to be carbon. Since the residue was confined to the exterior of the sherds and in no cases seems to have been substantial, it appears that this was not charred food but rather either soot from cooking or a deliberate blackening applied during manufacture. In this case the carbon could have had an age offset before adhesion and so no samples were submitted from this material.

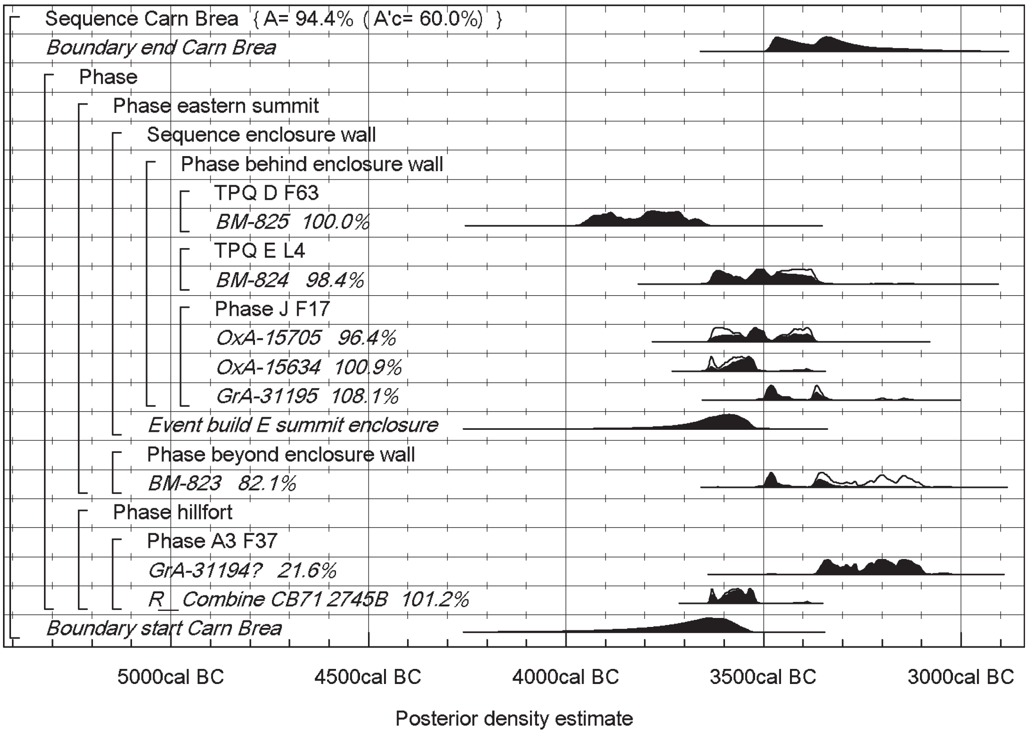


Fig. 10.25. Carn Brea. Probability distributions of radiocarbon dates. The format is the same as for Figs 10.8 and 10.12. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

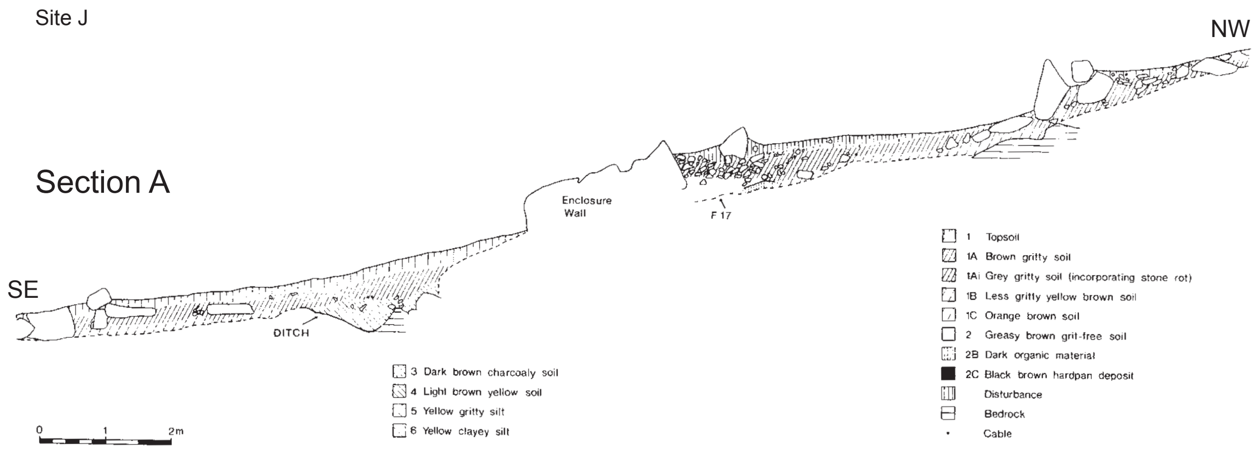


Fig. 10.26. Carn Brea. Section of the eastern summit enclosure in area J. After Mercer (1981a, fig. 24).

Results and calibration

Full details of all the radiocarbon measurements are given in Table 10.4.

Analysis and interpretation

The chronological model for the Neolithic activity at Carn Brea is shown in Fig. 10.25.

The eastern summit. Three carbonised residue samples were dated from F17, a hollow behind the wall on site J (Fig. 10.26; Mercer 1981a, figs 23–4). As at Helman Tor, the hollow contained an occupation deposit which built up against the wall and was sealed by its collapse. Two measurements from the carbonised residues on sherds from separate vessels (Fig. 10.25: *OxA-15634, -15705*) are statistically consistent (T'=1.0; T'(5%)=3.8; ν=1), although a third from another vessel (Fig. 10.25: *GrA-31195*) is more recent (T'=14.3; T'(5%)=6.0; ν=2). This may simply reflect the length of time over which the deposit accumulated. The residue dated by OxA-15705 contained relatively little carbon, although the consistency of this measurement suggests that it may be accurate.

These dates provide a *terminus ante quem* for the construction of the enclosure wall of *3885–3505 cal BC* (*95% probability*; Fig. 10.25: *build E summit enclosure*), probably of *3670–3535 cal BC* (*68% probability*).

The inner ramparts linking the summits. On site A3, two charcoal spreads lay at the tail of the rampart, to some extent protected by tumble from it (Mercer 1981a, fig. 44). This suggests that they were covered soon after deposition. Three replicate measurements have been made on carbonised residue from a vessel represented by two joining sherds from one of the patches (Table 10.4: GrA-31194, OxA-15632–3). These measurements are statistically inconsistent (T'=33.9; T'(5%)=6.0; ν=2), although the two measurements from the Oxford Accelerator, made using separate chemical preparations, are consistent (T'=0.9; T'(5%)=3.8; ν=1). All three measurements fall in the mid-fourth millennium cal BC, suggesting activity of this date in the area of the rampart. We have incorporated the weighted mean of the two consistent measurements in the model (Fig. 10.25: *CB71 2745B*), and have excluded the third, inconsistent, measurement from the analysis.

If the charcoal spreads and the artefacts contained within them were deposited in the course of activity in the shelter of the inner rampart, then *CB71 2745B* may provide a tentative *terminus ante quem* for the construction of this, of *3640–3515 cal BC* (*95% probability*; Fig. 10.25), probably of *3635–3625 cal BC* (*1% probability*) or *3595–3520 cal BC* (*67% probability*). It is more probable that the charcoal patches were overlain by material eroding from the tail of the rampart, in which case the date would provide a *terminus post quem* for its erosion. The preservation of the patches, however, suggests that they had not long been exposed before this took place.

Overall, Neolithic activity at Carn Brea started in *4040–3530 cal BC* (*95% probability*; Fig. 10.25: *start Carn Brea*), probably in *3755–3560 cal BC* (*68% probability*). Our estimate for the end of Neolithic activity on the site is strongly influenced by *BM-823*, a sample from a pit outside the enclosure on the eastern summit. The model suggests that the Neolithic activity at Carn Brea ended in *3495–3080 cal BC* (*95% probability*; Fig. 10.25: *end Carn Brea*), probably in *3485–3385 cal BC* (*33% probability*) or *3370–3270 cal BC* (*35% probability*). Overall this activity continued for *60–835 years* (*95% probability*; distribution not shown), or *115–480 years* (*68% probability*). The imprecision of these estimates emphasises the limitations of the current dating evidence for this site.

Implications for the site

The shape of the distribution for *start Carn Brea* given in the model presented above (Fig. 10.25) is not incompatible with the suggestion that the eastern summit tor enclosure began in the 37th century cal BC. This is probably a little later than the estimate for Helman Tor, but confirms in general that there is no perceptible difference in age between ditched enclosures to the east and the tor enclosures of the south-west. Carn Brea may have been in use for much longer than Helman Tor, but the estimates for the duration of this activity are imprecise, as emphasised above.

The tor enclosure is itself a substantial construction and, on the basis of extensive burning and the recovery of some 750 leaf arrowheads, it is probable that it was attacked. It seems that there was also a system of Neolithic outworks on Carn Brea, joining the eastern and central summits. The location and condition of finds are compatible with this reading of the evidence, and *CB71 2745B* can be interpreted as providing, tentatively, a *terminus ante quem* for the construction of these ramparts. The different styles of walling seen in the tor enclosure and the inner ramparts may indicate that this was not a unitary development, though its total area is well within the range seen in causewayed enclosures (Table 14.1). Intriguingly, the question is also now raised of the date – and possible role – of the central summit within the Neolithic complex at Carn Brea. The date of the outer circuit of ramparts remains uncertain although, given the scale of Rampart 3 in particular, an Iron Age date remains attractive.

10.6 The south-west peninsula

Enclosures: chronology and use

The models presented above suggest that both ditched and walled enclosures began to be built in the south-west peninsula from *c.* 3700 cal BC (Fig. 10.27). The inner circuit at Hembury and the stone-built enclosure at Helman Tor could be seen as the very first constructions in the region, followed by the other dated enclosures over the next century or two. A model which estimates the period during which their circuits were constructed is shown in Fig. 10.28. This suggests that Helman Tor may be the earliest (*64% probable*), although the limitations of the available samples from this site cannot be ignored. The outer ditch at Hembury is dated by residues on sherds from the burnt deposits which followed some primary silting, and the inner ramparts at Carn Brea are dated by measurements on only one sherd. The only available determination for the possible enclosure at High Peak, Sidmouth, was obtained long ago on a bulk charcoal sample and has so large a standard deviation as to provide a *terminus post quem* spanning almost the whole of the fourth millennium cal BC (Table 10.5: BM-214; 3960–3120 cal BC).

Enclosures in the south-west were used for varying lengths of time (Fig. 10.29). None appears to have been in very short primary use, for a generation or less. Raddon may have been in use for under a century (Fig. 10.29: *use Raddon inner*), although it should be noted that at least one layer with a substantial Neolithic assemblage overlay the context of the latest dated samples. The other three dated enclosures were probably each used for at least a century, Hembury perhaps for between one and two centuries (Fig. 10.13: *use Hembury*). The duration of activity at Helman Tor and Carn Brea is known less precisely, although both may have been in use for a century or two (Fig. 10.29).

We have argued that there is no obvious difference

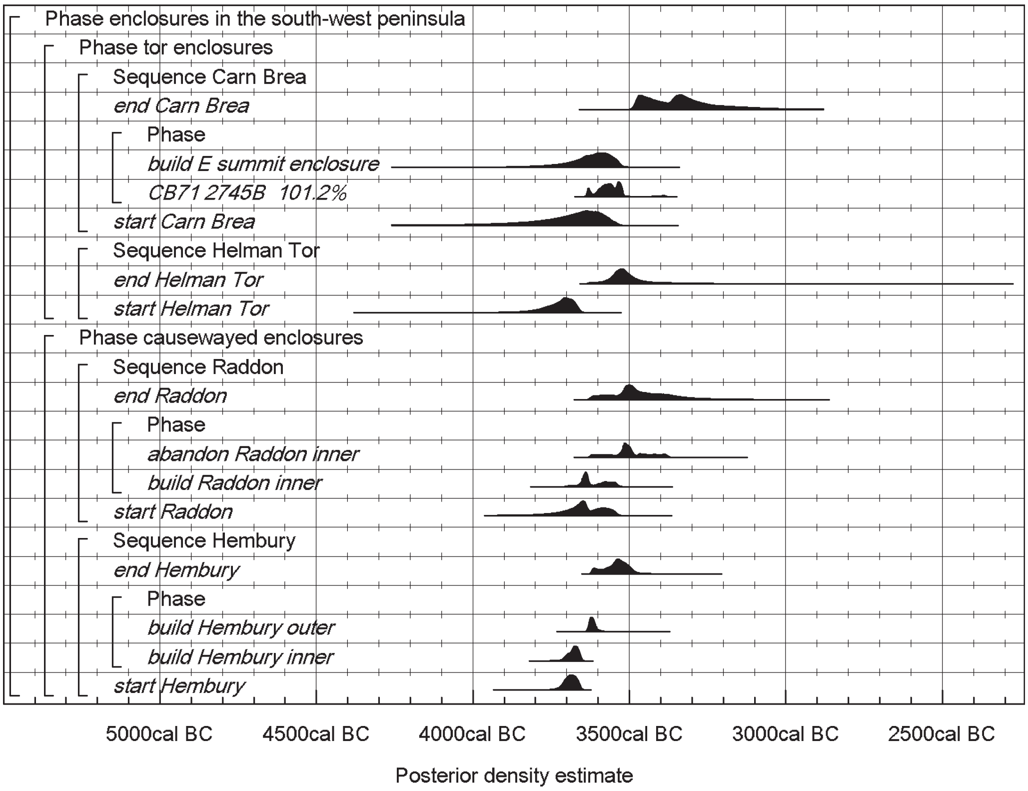


Fig. 10.27. The south-west. Probability distributions of key parameters for enclosures, derived from the models defined in Figs 10.9–12 (Hembury), Fig. 10.16 (Raddon), Fig. 10.22 (Helman Tor), and Fig. 10.25 (Carn Brea).

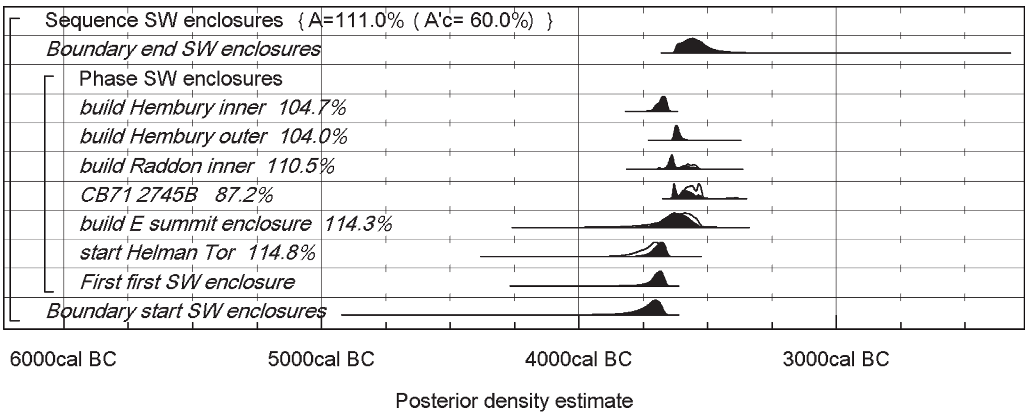


Fig. 10.28. The south-west. Probability distributions of construction dates of circuits from enclosures, derived from the models defined in Figs 10.9–12 (Hembury), Fig. 10.16 (Raddon), Fig. 10.22 (Helman Tor), and Fig. 10.25 (Carn Brea). This model estimates the period during which the circuits were constructed. The format is the same as for Fig. 10.8. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

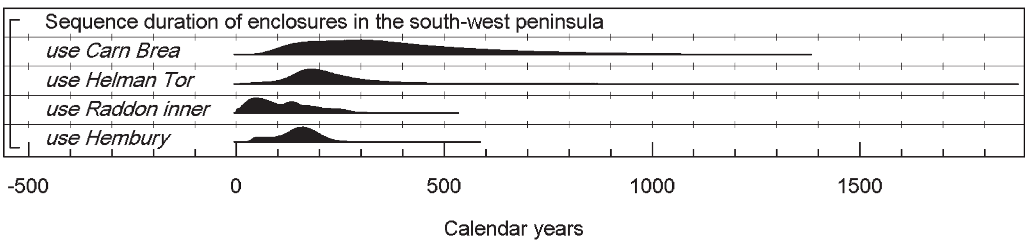


Fig. 10.29. The south-west. Probability distributions of the number of years during which the enclosures were in primary use, derived from the models defined in Figs 10.9–12 (Hembury), Fig. 10.16 (Raddon), Fig. 10.22 (Helman Tor), and Fig. 10.25 (Carn Brea).

Table 10.5. Radiocarbon dates from High Peak, Hazard Hill, Haldon, Tiverton, Marldon, Castle Hill, Broken Cavern, Three Holes Cave, Bob's Cave, Tornewton Cave, Broadsands, Cow Cave, Portscatho, Metha, Tregarrick, Poldowrian, Tremough, Trenowah and Penhale Round. Posterior density estimates derive from the model defined in Fig. 10.30.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
High Peak, Sidmouth, Devon								
BM-214		Unidentified bulk charcoal sample	Neolithic occupation sealed under Dark Age rampart (S. Pollard 1966, fig. 3; 1967; H. Barker *et al.* 1969b)	4810±150			3960–3120	*3945–3515*
Hazard Hill, Totnes, Devon								
BM-149	CHB4	Unidentified bulk charcoal sample	Area B, cooking hole 4 (Houlder 1963; Barker and Mackey 1968)	4920±150			4040–3360	*3995–3520*
BM-150	B112	Unidentified bulk charcoal sample	Occupation level (Barker and Mackey 1968)	4700±150			3790–3020	*3930–3875* (*2%*) or *3805–3490* (*93%*)
Haldon, Devon								
AA-34137		*Quercus* sapwood and Pomoideae charcoal	Trench B/C, test pit 3, pit 543, context 544. Fill of pit containing a small amount of struck flint (Gent and Quinnell 1999a, 84, 100)	4475±60	−24.6		3370–2920	
Uplowman Road, Tiverton, Devon								
HAR-8544		Bulk sample of mature *Quercus* sp. charcoal	Old land surface beneath mound of long barrow. Mesolithic lithics present (G. Smith 1990)	8310±100	−26.9		7580–7060	
Bulleigh Meadow, Marldon, Devon								
HAR-10192	625	Bulk sample of oak trunkwood charcoal	Context 319. Fill of pit without diagnostic artefacts, cut by ?late Neolithic cremations (Berridge and Simpson 1992, 3, 17)	5100±70			4050–3700	
Castle Hill, Brinor, Devon								
AA-30670		*Prunus*. Small roundwood charcoal fragments from a mixed collection of *Prunus*, Pomoideae and *Salix/Alnus*	Enclosure 219, feature 217 (part of S side of 'mortuary' enclosure), single surviving fill of a feature which was less than 0.20 m deep when excavated. Possibly contemporary with construction, possibly redeposited (Fitzpatrick *et al.* 1999, fig. 8; 63)	4630±50	−25.0		3630–3140	
Beta-78183		Unidentified charcoal	Enclosure 219, feature 510 (possible terminal of S side of 'mortuary' enclosure), secondary fill (Fitzpatrick *et al.* 1999, fig. 8)	4220±60	−25.0 (assumed)		2920–2620	
Broken Cavern, Devon								
OxA-3205	BRKFA 602	Sheep. Molar	Neolithic occupation horizon with rich assemblage of flint artefacts and South-Western Bowl pottery (Roberts 1996)	4930±90	−21.5		3960–3520	*3825–3620* (*88%*) or *3605–3530* (*7%*)
OxA-3206	BRKFA 513	Human. Tooth	From the same context as OxA-3205	4885±90	−21.0		3940–3380	*3800–3530*
OxA-3207	BRKFA 665	Cattle. Tooth, juvenile	From the same context as OxA-3205	5115±80	−21.0		3980–3640	*3860–3640*
Three Holes Cave, Devon								
OxA-4491	THRFA 1181	Red deer. Radius	Later Mesolithic context (Roberts 1996)	6330±75	−21.7		5480–5070	
OxA-4492	THRFA 890	Red deer. Navicular-cuboid	From the same context as OxA-4491	6120±75	−21.5		5300–4840	
OxA-3889	THRFA 797	Pond tortoise. Plastron fragment	Base of context RST (Roberts 1996)	4650±70	−21.3		3640–3120	
OxA-4493	THRFA 1088	Aurochs. Upper L premolar	Neolithic horizon BST (Roberts 1996)	5060±70	−22.1		3990–3670	*3870–3655*
OxA-4495	THRFA 1186	Aurochs. Molar	From the same context as OxA-4493	5010±70	−21.3		3970–3640	*3855–3640*
Bob's Cave, Kitley, Yealmpton, Devon								
OxA-4983		Human. Femur	Excavated from deposits yielding late Upper Palaeolithic artefacts (Chamberlain 1996; Roberts 1995; R. Hedges *et al.* 1998, 437)	5035±70	−20.3		3980–3650	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Tornewton Cave, Devon								
OxA-5864		Human. Right second lower incisor	Excavated 1953 from a breccia known as the 'Reindeer Stratum' outside the cave entrance. Deposit contained a broken Creswell or Cheddar point and Pleistocene fauna (Sutcliffe and Zeuner 1958, 138–41; R. Hedges *et al.* 1997, 446; Chamberlain 1996)	4680±60	−21.3		3640–3350	
Broadsands, Devon								
OxA-17164	A3038.71	Adult-size male, left talus	One of at least four distinct individuals in the chamber, badly disturbed, of a simple stone monument, excavated in 1958 (Radford 1958; Sheridan *et al.* 2008). This sample derives from below paving slab in the chamber	5011±32	−20.4		3950–3700	*3805–3705*
OxA-17165	A3038.88	Adult-size (?male), left talus	A second adult-sized human: as OxA-17164	4999±31	−20.3		3940–3700	*3800–3705*
OxA-17166	A3039.51	Adult-size (?male), left talus	A third adult-sized human. This came from the SW corner of the chamber, which has no stratigraphic relationship with the paving slab (Sheridan *et al.* 2008)	4635±31	−20.9		3520–3350	
OxA-17979	A3040.40	Adult (sex indeterminate) human long bone	Potentially another (fifth) individual from the chamber, though conceivably from one of the adults represented by the tali (Sheridan *et al.* 2008). This sample derives from above the paving slab in the chamber	5029±30	−20.0	4982±24 BP T'=6.2; T'(5%)=3.8; ν=1	3950–3350	*3815–3705*
OxA-12739	A3040.44	Replicate of OxA-17979	As OxA-17979	4912±36	−20.1		3780–3630	*3785–3650*
OxA-17167	A3040.17	Child cranium (sex indeterminate)	The fourth certain human from the chamber, from above paving in the chamber (Sheridan *et al.* 2008)	3607±30	−20.8		2040–1880	
OxA-17168	A3040.46a	Maxilla of subadult pig	Overlying but not in direct contact with the paving in the SE corner of the chamber (Sheridan *et al.* 2008)	4225±30	−20.2	4210±22 BP T'=0.5; T'(5%)=3.8; ν=1	2900–2700	
OxA-17169	A3040.46b	Replicate of OxA-17168	As OxA-17168	4195±30	−20.2			
Cow Cave, Chudleigh, Devon								
OxA-17308	A5864	Right clavicle of adult human	From one of two individuals (on the basis of size differences), from one of a number of small caves, shelters and fissures at Chudleigh Rock, excavated between 1927 and 1934 (Sheridan *et al.* 2008)	4967±32	−20.8		3900–3650	
OxA-17307	A5862	Left clavicle of adult human	From one of two individuals (on the basis of size differences), from one of a number of small caves, shelters and fissures at Chudleigh Rock, excavated between 1927 and 1934 (Sheridan *et al.* 2008)	4905±32	−21.2		3760–3630	
Portscatho, Cornwall								
Wk-13259		*Corylus* charcoal	Pit 512, context 511. One of a group of pits containing South-Western style pottery in gabbroic and other fabrics, worked flint and chert, charred wheat, barley and hazel nut shell (Jones and Reed 2006)	4713±45	−24.8±0.2		3640–3360	*3640–3505*
Wk-13257		*Corylus* charcoal	Pit 504, context 503. One of a group of pits containing South-Western style pottery, worked chert, a charred wheat grain and hazel nut shell (Jones and Reed 2006)	4805±51	−25.0±0.2		3690–3380	*3695–3675* (*3%*) or *3670–3520* (*92%*)
Wk-13256		*Corylus* charcoal	Pit 502, context 501. One of a group of pits containing South-Western style pottery in gabbroic fabric, charred wheat, barley and hazel nut shell (Jones and Reed 2006)	4818±48	−26.7±0.2		3700–3510	*3695–3525*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Wk-13258		*Corylus* charcoal	Pit 506, context 505. One of a group of pits containing South-Western style pottery in gabbroic fabric, a quartzite rubber, charred vetch seeds and hazel nut shell (Jones and Reed 2006)	4952±45	−25.3±0.2		3910–3640	*3795–3650*
Metha, Cornwall								
Wk-12676		*Corylus* charcoal	Pit 370. Containing charcoal and 4 flint flakes (Jones and Reed 2006, 14; Jones and Taylor forthcoming)	4505±45			3370–3020	
Tregarrick, Cornwall								
Wk-14916		*Corylus* charcoal	Pit 40, context 41. Single fill, containing gabbroic sherds, struck flint, struck flint and charcoal	4914±40	−26.4±0.2		3780–3630	*3770–3640*
Wk-14918		Pomoideae charcoal	Pit 48, context 31. Single fill, containing gabbroic and other sherds, struck flint (some of it nodular), charcoal	4908±47	−25.1±0.2		3790–3630	*3780–3635*
Wk-14913		Hazelnut shell	Pit 19, context 20. Single fill, possibly with *in situ* burning towards base, containing a small cup in a local fabric deposited as 3 sherds, single gabbroic sherd, small sandstone quern, struck flint, charred hazelnut shells (Cole and Jones 2003)	4839±42	−25.1±0.2		3710–3520	*3705–3620* (*65%*) or *3605–3530* (*30%*)
Wk-14917		Hazelnut shell	Pit 45, context 47. Charcoal-rich lower fill of pit with signs of *in situ* burning. Contained substantial parts of 3 pots in the South-Western style, 2 of them in gabbroic fabrics, struck flint and a quartzite cobble, charred hazelnut shells. Pit surrounded by 3 stakeholes	4768±43	−22.7±0.2		3650–3370	*3645–3520*
Wk-14914		Hazelnut shell	Pit 21, context 22. Single fill, with charcoal and numerous slate fragments, charred hazelnut shells (Cole and Jones 2003)	4775±44	−24.4±0.2		3650–3370	*3645–3520*
Wk-14915		Hazelnut shell	Pit 27, context 28. Single fill, with sherds in local and gabbroic fabrics, struck flint (some of it nodular), 2 unworked cobbles, charcoal, charred hazelnut shells (Cole and Jones 2003)	4776±44	−24.6±0.2		3650–3370	*3645–3520*
Poldowrian, St Keverne, Cornwall								
HAR-4323		All the charcoal from the pit, mainly *Quercus* with some Pomoideae	Area 2, pit 106. Pit containing sherds, one of them in the South-Western style and a leaf arrowhead (Smith and Harris 1982, 30, 49, fig. 6, fig. 18: 83, 86)	5180±150	−25.1		4340–3650	*4330–3695*
HAR-4052		*Quercus* charcoal	Area 2, pit 128. Pit containing much charcoal and numerous stones, sherds in top fill (Smith and Harris 1982, 30, fig. 6)	4870±130	−25.6		3960–3360	*3945–3525*
HAR-4568		All the charred hazelnut shell from level 2	Area 2, level 2. Horizon below ploughsoil, in which Neolithic features were visible and Mesolithic and Neolithic lithics were present (Smith and Harris 1982, 30). Sample may have included material of both periods	6450±110			5620–5210	
Tremough, Penryn, Cornwall								
AA-44604		*Corylus* charcoal	Ditch 76, context 77. Stony upper fill (backfilled?) of shallow ditch within high-density flint scatter, containing 1 ?Neolithic sherd (Cole and Jones 2003, 139; Gossip and Jones 2007)	4995±50	−26.7		3950–3650	
AA-44601		*Corylus* charcoal	Pit 21, context 22. Charcoal-rich pit with burnt stone within low-density flint scatter (Cole and Jones 2003, 139; Gossip and Jones 2007)	4850±55	−27.4		3720–3520	
Trenowah, St Austell, Cornwall								
Wk-11935		*Salix* charcoal	Pit 40. One of a group of charcoal-rich pits, at least some containing pottery (Cole and Jones 2003, 118, 139)	4429±41	−26.5±0.2		3340–2910	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Penhale Round, Indian Queens, Cornwall								
Wk-9839		*Triticum* sp. grains	Pit 254. Within rectangular post-built structure 3299, 10 m wide x >19 m long. Pit contained sherds from several Bowls, one substantially complete, some in gabbroic fabrics, calcined cattle and sheep bone (Cole and Jones 2003, 119; Jacqueline Nowakowski pers. comm.)	5001±75	−23.5±0.2		3970–3640	*3855–3635*
Wk-9840		*Corylus/Alnus* charcoal	Posthole 3221 of rectangular structure 3299, a further posthole of which contained Bowl sherds and another struck flint (Jacqueline Nowakowski pers. comm.)	4951±61	−25.7±0.2		3940–3630	*3805–3635*
Wk-9843		*Quercus* charcoal	Stakehole of circular structure 3053, 4 m in diameter and associated with nodular flint but without other artefacts (Jacqueline Nowakowski pers. comm.)	4908±67	−25.1±0.2		3910–3530	

in age between the causewayed enclosures and the tor enclosures of the south-west peninsula (Fig. 10.27). Does this mean that their use and significance were identical? The distributions of certain and probable examples of both are mutually exclusive (Fig. 10.1). It is as if tor enclosures were the preferred form in the circumscribed areas where it was possible to build enclosures by linking abrupt outcrops with boulder walls. They can readily be seen as defensive, presenting continuous barriers, with some very narrow, strongly built entrances. The strong walls at Carn Brea, incorporating impressive orthostats, may imply anticipation of attack, to which the presence of so many leaf arrowheads may bear witness. These observations and the fact that structures in the interior had been extensively burnt have been taken as firm evidence of 'an assault involving massed archers followed by frenzied destruction' (Mercer 1999, 153). Among the causewayed enclosures, there is evidence for banks backing the interrupted ditches at both Hembury and at Raddon, although it is hard, even at Hembury, to tell whether these were continuous. Is this a fundamental difference between the two kinds of enclosure? Or can the tors and outcrops joined by walling be seen as in some way equivalent to the causeways of ditched enclosures?

Causewayed and tor enclosures in the peninsula are linked, at Hembury and Carn Brea, by evidence for attack and throughout by the deposition of a shared material culture. All the excavated examples are characterised by the deposition of gabbroic pottery and of greenstone axeheads ascribed to south-western, generally Cornish, sources. They also shared, to varying extents, the use of axeheads of flints different to those knapped on the sites and the working of non-local flint. While the extent of this last has been exaggerated in Devon, as John Newberry has shown (2002), Cornwall has few flint sources other than beach pebbles, and there is a contrast between the dominance of chert and beach flint in Mesolithic industries there (Berridge and Roberts 1986, 13) and the frequency of non-beach, often Chalk, flint in those of the early Neolithic (e.g. Saville 1981, 108–9). This concatenation of transported objects and materials at enclosures has led to their being seen as nodes in a long-distance exchange network which extended farther east to causewayed enclosures in Wessex (e.g. Mercer 1986, 49–54).

Beyond enclosures: occupation sites

What came before enclosures in the south-west? We need to consider both occupation sites and other monuments. Our knowledge of the late Mesolithic and earliest Neolithic in the peninsula is patchy. Late Mesolithic finds are concentrated on Exmoor, Dartmoor, Bodmin Moor and the present coast, with a focus in West Penwith (Jacobi 1979, fig. 17; Berridge and Roberts 1986, fig. 7), and short-lived, localised episodes of vegetation clearance are known from moorland, lowland bogs and floodplains (Wilkinson and Straker 2008). We do not know the latest dates of the Mesolithic in the south-west. Two sixth millennium cal BC dates from Three Holes Cave, Torbryan, in south Devon,

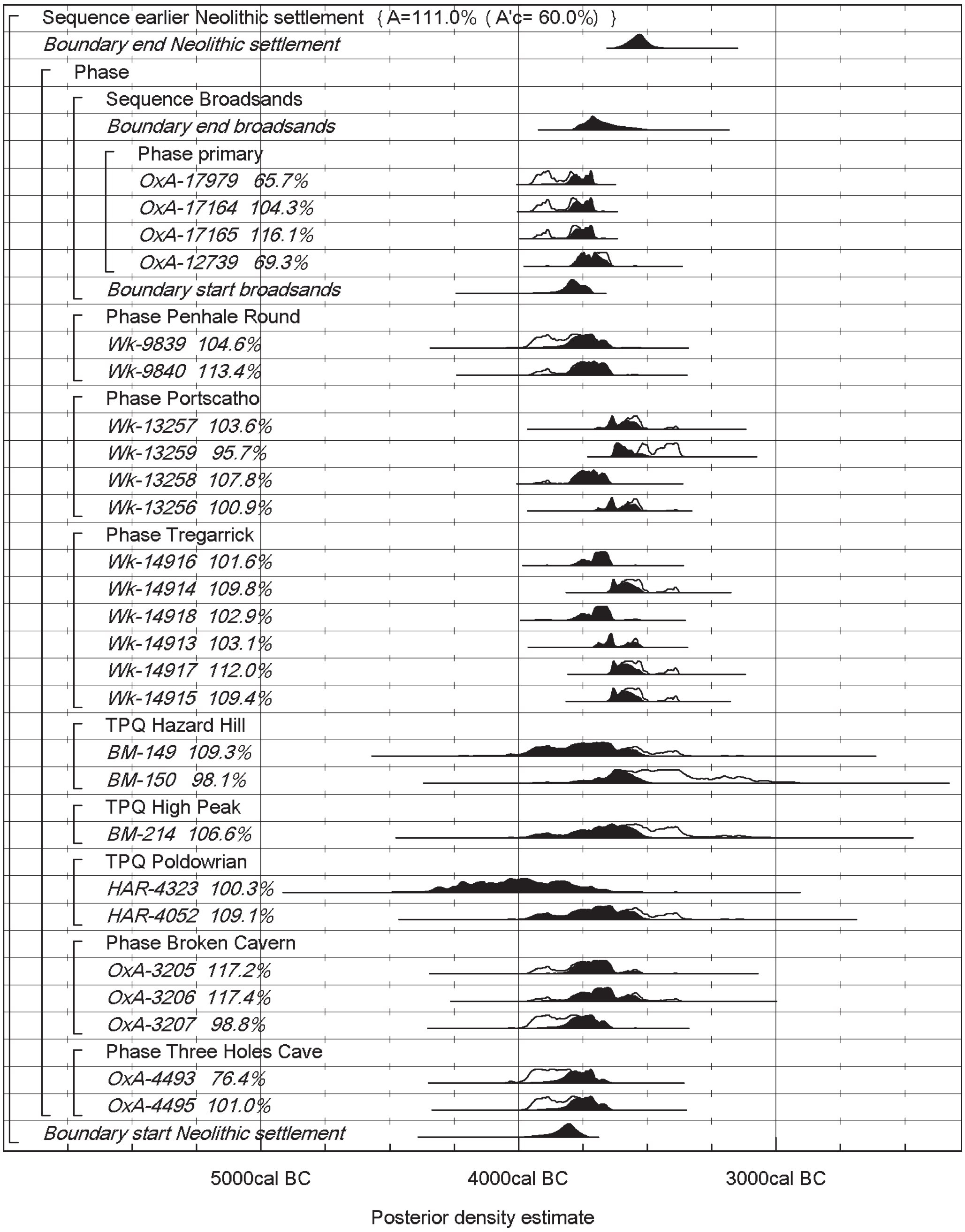


Fig. 10.30. The south-west. Probability distributions of dates associated with diagnostically early Neolithic material culture (excluding those from enclosure sites). The format is the same as for Figs 10.8. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

indicate an interval between the later Mesolithic and early Neolithic uses of the site (Table 10.5: OxA-4491−2). A further sixth millennium date from Poldowrian, St Kerverne (Table 10.5: HAR-4568), may have been measured on a combination of Mesolithic and Neolithic material (Smith and Harris 1982, 49).

Details of dates from fourth millennium cal BC contexts other than enclosures in the south-west are given in Table 10.5. BM-149 and -150 were prepared and dated by GPC of acetylene as described by Barker and Mackey (1959). BM-214 was dated as described by H. Barker *et al.* (1969b). OxA-3205–7, -3889 and -4491–5 were prepared and measured as described by Law and Hedges (1989) and R. Hedges *et al.* (1989a; 1992b), using the CO_2 gas ion-source (Bronk and Hedges 1989). Four samples (AA-30670, -34137, -44601, -44604) were prepared and graphitised at SURRC according to the methods outlined by Stenhouse and Baxter (1983) and Slota *et al.* (1987) and measured using AMS at the University of Arizona (Donahue *et al.* 1997). Two samples from Poldowrian were measured in 1980 and 1983 by AERE Harwell using methods described by Mook and Waterbolk (1985), Otlet and Warchal (1978) and Otlet (1979). A single sample (Beta-78183) was dated by Beta Analytic Inc in 1994 by LSC using methods

described at http://radiocarbon.com/analytic.htm. The samples from Broadsands and Cow Cave, Chudleigh, were dated by the Oxford Radiocarbon Accelerator Unit in 2005–6, using methods described by Bronk Ramsey *et al*. (2004a; 2004b). The remaining samples listed in Table 10.5 were pre-treated and graphitised at the University of Waikato Radiocarbon Dating Laboratory (Mook and Waterbolk 1985; Slota *et al.* 1987) and dated by AMS at the Rafter Radiocarbon Laboratory (Zondervan and Sparks 1997; Zondervan *et al.* 2007).

Despite the interval between the Mesolithic and Neolithic use of Three Holes Cave (Table 10.5), the common location of activity of both periods suggests common priorities in site selection, also seen at Poldowrian and at Hembury, where Peter Berridge has shown at the latter site that the Mesolithic presence was greater than originally thought (1986). Five dates on disarticulated animal bone samples from Neolithic levels at Three Holes Cave and neighbouring Broken Cavern strictly speaking provide only *termini post quos* for Neolithic activity at both, in the latter case associated with South-Western style pottery (Fig. 10.30: *OxA-3205–7*, *-4493* and *-4495*). The fact that they are all statistically consistent (T'=3.0; T'(5%)=9.5; ν=4), however, suggests that they do indeed date the occupation.

At Poldowrian, St Keverne, Neolithic pits, some containing pottery in the South-Western style, were dug in the area of a dense late Mesolithic flint scatter on what is now a cliff-top (Smith and Harris 1982). The Neolithic dates from Poldowrian are both *termini post quos,* falling in the first half of the fourth millennium cal BC (Fig. 10.30: *HAR-4052, -4323*). They are little more informative than that for High Peak or those providing similar *termini post quos* for occupation, including further pits with South-Western style pottery, at Hazard Hill (Houlder 1963; Fig. 10.30: *BM-149, -150*).

Pits, long known from hilltop sites such as Hazard Hill, have increasingly been recognised in lower-lying locations, such as the A30 roadworks between Honiton and Exeter, Hayes Farm, near Exeter, Tiverton, and an area at Tregarrick Farm, Roche, in Cornwall (Fitzpatrick *et al*. 1999, 138; Cole and Jones 2003). At Tregarrick Farm, a series of pits containing South-Western style pottery, struck flint, a saddle quern and charred hazelnuts were interpreted as the result of ritualised activity associated with seasonal gathering, in this case linked to the Roche Rock, a prominent and isolated granite outcrop less than 200 m distant (Cole and Jones 2003). These and other recently excavated pit groups, notably at Portscatho, where four have been excavated (Jones and Reed 2006), have begun to provide dates on short-life samples which better define the use-life of such sites and help to relate them to the enclosures.

Another example is Penhale Round, where a date has been obtained on grains of *Triticum* sp. from a pit containing South-Western style pottery, bones of domesticated animals and struck flint (Fig. 10.30: *Wk-9839*; Cole and Jones 2003, 119). The only dates available for houses in the south-west are from this one site. One, on short-life charcoal (Fig. 10.30: *Wk-9840*), is from a posthole of a rectangular structure 10 m wide and more than 19 m long, within which the dated pit lay; the other, on oak charcoal, provides a *terminus post quem* for one stakehole of a circular structure 4 m in diameter associated with nodular flint but without other artefacts (Table 10.5: Wk-9843).

The Broadsands monument at Paignton in east Devon (Radford 1958) is unusual in the context of the peninsula as a whole (see Daniel 1950). It has been linked to passage tombs or graves in general (Radford 1958, 158–9), and recently to passage graves of various forms in north-west France (Pailler and Sheridan 2009; Sheridan *et al.* 2008). Excavation of the disturbed chamber yielded a few hard, thin, fine, burnished sherds probably from two pots, probably of Carinated Bowl form (Radford 1958, 160–3, fig. 4: 1, 2; Sheridan *et al*. 2008). The remains of two individuals were recovered from beneath the stone paving of the chamber, and the remains of two more, and possibly a fifth individual, from above it; small bones were present but is unclear whether the human remains were articulated when originally buried (Sheridan *et al.* 2008). These, along with pig remains also from above the stone paving in the chamber, have been dated (Fig. 10.30: Table 10.5: OxA-12739, 17164–9, 17979; Sheridan *et al.* 2008).

Although the presence of small footbones might suggest that these individuals entered the tomb as fleshed corpses or otherwise articulated, subsequent disturbance of the monument has made it impossible to resolve the order in which these individuals died and were deposited. In particular the articulated remains claimed from above the paving slab by Radford (1958) seem now to consist of two femurs (Sheridan *et al.* 2008). We therefore follow Sheridan *et al.* (2008, fig. 6) in modelling the early Neolithic use of this tomb as a simple phase (Fig. 10.30). As both this monument and the material which it contains are taken by us as diagnostic of Neolithic activity, we have included this model in the overall model for early Neolithic settlement in the south-west peninsula. This wider model suggests that the Broadsands tomb was established in *3870–3710 cal BC* (*95% probability*; Fig. 10.30: *start broadsands*), probably in *3815–3740 cal BC* (*68% probability*). This first phase of deposition in the Broadsands tomb ended in *3780–3545 cal BC* (*95% probability*; Fig. 10.30: *end broadsands*), probably in *3760–3640 cal BC* (*68% probability*).[1] Two later episodes of deposition are also indicated (Table 10.5; Sheridan *et al.* 2008).

The chronological model shown in Fig. 10.30 includes dates from sites other than enclosures which contained diagnostic early Neolithic material. It suggests that this earliest Neolithic activity in the south-west peninsula began in *3940–3735 cal BC* (*95% probability*; Fig. 10.30: *start Neolithic settlement*), probably in *3855–3765 cal BC* (*68% probability*). This phase of activity, including the use of South-Western style pottery and gabbroic fabrics, continued until *3615–3465 cal BC* (*95% probability*; Fig. 10.30: *end Neolithic settlement*), probably in *3570–3500 cal BC* (*68% probability*). This period of activity endured for *150–450 years* (*95% probability*; Fig. 10.31: *duration early Neolithic*), probably for *210–345 years* (*68% probability*).

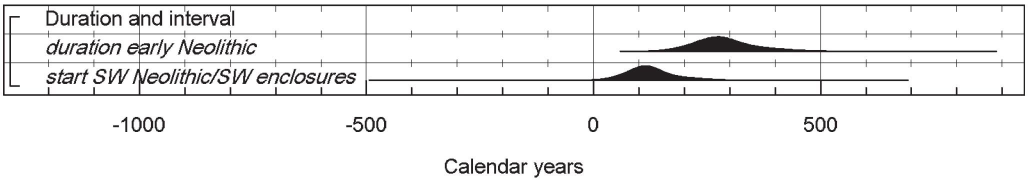


Fig. 10.31. The south-west. Duration of early Neolithic settlement activity, derived from the model defined in Fig. 10.30, and the interval between the start of this settlement and the first enclosure construction (see text).

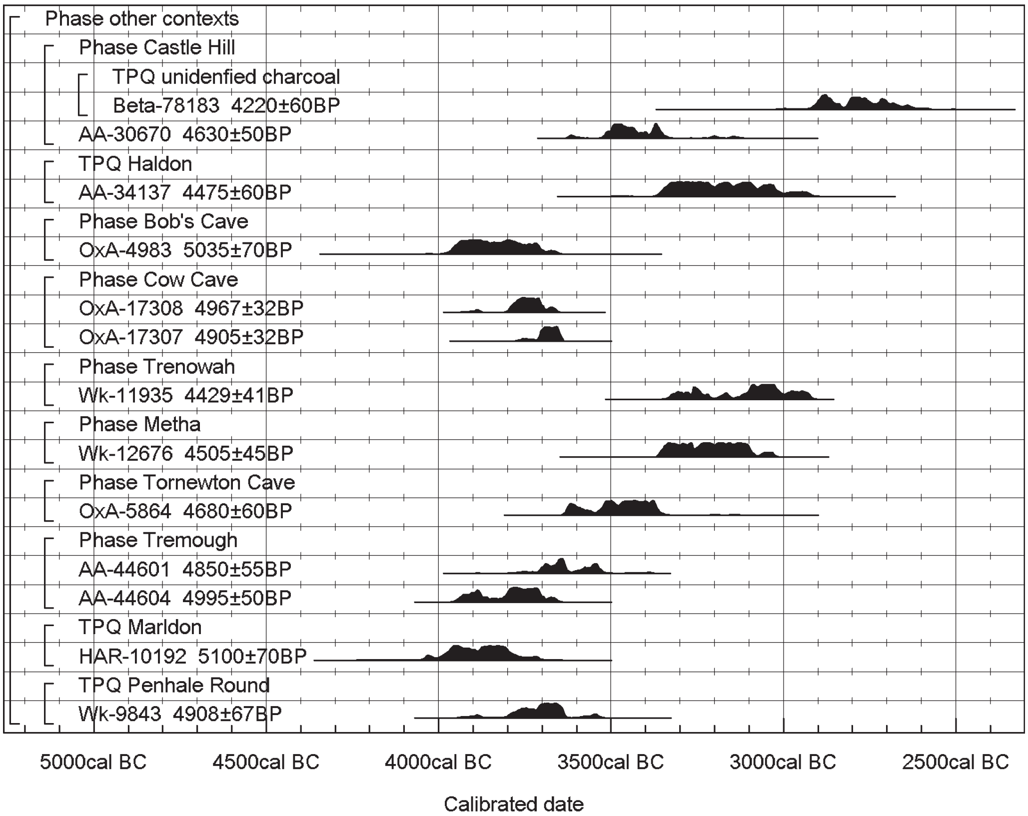
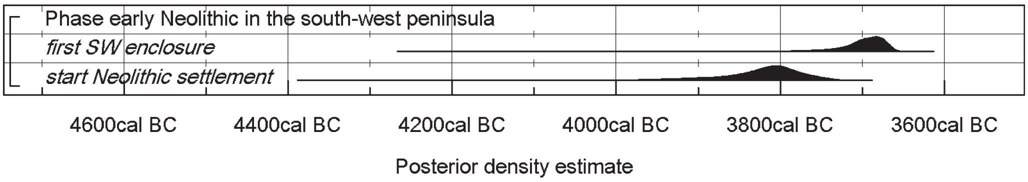


Fig. 10.32. The south-west. Calibrated radiocarbon dates from other fourth millennium contexts not associated with diagnostic early Neolithic cultural material.

Where the pottery from contexts dated to the earlier fourth millennium cal BC has specific attributes, it belongs predominantly to the South-Western style, and includes gabbroic fabrics at Hazard Hill, Poldowrian, Tregarrick and Portscatho. Light-rimmed, Carinated Bowl forms, without South-Western elements, are present in a small pit group from Long Range, on the A30 between Honiton and Exeter (Laidlaw 1999, fig. 79) and perhaps in an assemblage sealed beneath the bank of an undated, single-entranced, rectilinear enclosure at Nymet Barton, also in Devon (C. Caseldine *et al.* 2000, 68–9), although this material is not yet fully published. On typological grounds, these two assemblages might predate both the development of the South-Western style and the enclosures. The Carinated Bowl pottery from the dated context of Broadsands has been noted above; this clearly predates the appearance of stone-walled and causewayed enclosures in the south-west, but does not appear earlier here than contexts with South-Western style pottery. We return to the wider implications of this in Chapter 14.

Further pits have produced material which has been dated to the fourth millennium cal BC (Fig. 10.32). None of these features contained diagnostic artefacts; examples include pits at Tremough, Penryn, Cornwall (Gossip and Jones 2007, 6–11), and Bulleigh Meadow, Marldon, in south Devon (Berridge and Simpson 1992). Some of these sites have other undated pits, such as the four at Tremough (Gossip and Jones 2007, 6–11), or several of those on Hazard Hill (Houlder 1963, 14), suggesting that many pits of Neolithic date may have gone unrecognised. Likewise, samples of human bone from three caves have also yielded fourth millennium cal BC dates (Fig. 10.32; Table 10.5). It should be noted that these have terrestrial isotopic signatures (Schulting and Richards 2002a; Sheridan *et al.* 2008).

As we have seen, there were also numerous pits at the Hembury enclosure, in which significant quantities of artefacts were placed, as at enclosures farther east. This provides a link between the unenclosed sites and the enclosures. The finds and the character of their deposition



10.33. The south-west. Probability distributions for the start of Neolithic settlement, derived from the model shown in Fig. 10.30, and the construction of the first enclosure in the region, derived from the model shown in Fig. 10.28.

in pits at Tregarrick Farm, for example, would not be out of place at Hembury. Perhaps it was primarily the numbers of people involved that separated these two types of site; both were probably similar in their locations in prominent places in the landscape, perhaps foci for periodic gatherings, repeated use and the burial of cultural material.

Enclosures and other sites: a chronological comparison

Comparison between the first enclosure construction in this region and the start of Neolithic activity calculated by the model shown in Fig. 10.30 suggests that the start of the Neolithic in this region predates the first enclosure (*99% probable*). Calculation of the difference between *start Neolithic settlement* (Fig. 10.30) and *first SW enclosure* (Fig. 10.28) suggests that there was an interval of *15–265 years* (*95% probability*; Fig. 10.31: *start SW Neolithic/SW enclosures*), probably an interval of *60–170 years* (*68% probability*). In this region, there therefore appears to have been an interval of perhaps around a century or so – four or five generations – between the beginnings of recognised Neolithic activity, including the use of cereals, and the initiation of enclosures (Fig. 10.33). We will return to the wider significance of this in Chapters 14 and 15.

Enclosures and other monuments in the south-west peninsula

Turning to monuments, we have presented the dating evidence for Broadsands above. Other candidates for an early date, on grounds of morphology, include the quoits or portal dolmens of the far south-west.[2] Related monuments in west Wales have early forms of Neolithic pottery, but no radiocarbon dates except at Carreg Coetan, Pembrokeshire (Chapter 11; summarised by Cummings and Whittle 2004, 27, 45, 58–9). It has been suggested that there was a close relationship between the natural forms of tors and other outcrops in the south-western landscape and the architecture of portal dolmens (e.g. R. Bradley 1998b; Tilley and Bennett 2001). The juxtaposition of the Tregarrick Farm occupation and the Roche Rock can be noted again here (Cole and Jones 2003).

Further, we simply do not know the chronology of the entrance graves.[3] Elsewhere in southern Britain, it has been claimed that long barrows probably cannot be seen as beginning before the 38th century cal BC (Whittle *et al*. 2007a; and see Chapter 14). (The first depositions in the stone setting at Coldrum, Kent, however, appear to belong earlier: see Chapter 7.) If the same chronology applies to the relatively few known and suspected long barrows in the south-west, that would allow the possibility, once again, of other forms of public architecture in the landscape up to a century or more before the first enclosures. The monument at Broadsands certainly seems to be constructed in this early pre-enclosure phase in the south-west peninsula.

Material culture: chronologies and connections

The chronology outlined here helps to answer long-discussed questions of the development of material culture, and beyond that, to contribute to characterising the social world of which these materialities were part.

There are indications of exchange over varying distances, probably parts of a continuum rather than distinct systems. Pots in gabbroic fabrics were being transported locally from their source area over distances of up to 50 km, from at least early in the 37th century cal BC, to be deposited in the earlier as well as the later pits at Tregarrick Farm alongside sherds in local fabrics (Quinnell 2002, 113, 119). They may have reached Helman Tor as early, but caution is called for here, given the problems with the dating of this site. Perhaps from the 37th century cal BC, local transport on a substantial scale, although over no more than 20 km or so, is evidenced by the exclusively gabbroic composition of the Carn Brea assemblage (although again the limitations of the dating for this site must be acknowledged). At this stage selected gabbroic vessels were being taken over longer distances to Hembury and Raddon. We discuss the more general currency of gabbroic fabrics and their longer-distance movement in Chapter 14.5. Other kinds of fabric were also circulating at a local level. A substantial part of the Hembury assemblage consists of vessels tempered with Carboniferous vein quartz, like the majority of the Neolithic pottery from Raddon, 20 km to its west, where the area of manufacture may have lain, if it was not farther west again (Quinnell 1999).

Nodular flint was placed in one of the earlier pits at Tregarrick probably in the earlier 37th century cal BC (Lawson-Jones 2003), probably before the construction of Carn Brea and perhaps that of Helman Tor, at both of which it was present (Saville 1981, 1997). Axeheads, or fragments of them, of distinctive flints are noted from Carn Brea (Saville 1981, 138–40), Helman Tor (Saville 1997, 48), Hembury (Liddell 1935, 162) and High Peak (S. Pollard 1966, 52), and may thus also have been introduced from the 37th century cal BC onwards. Introductions from remote sources which may date as early include two

tuff implements from Carn Brea attributed to Welsh or Cumbrian sources, one of them stratified in a Neolithic context (I. Smith 1981). The possibility of a northern French source for an axehead of exceptional fan-shaped outline from near the base of the outer ditch at Raddon (Quinnell and Taylor 1999) should not be overlooked. A flake found on the surface of Hazard Hill (petrology number DEV 134) is diversely published as Group VI, from Cumbria (Davis *et al.* 1988, 16) and Group IX, from Antrim (Clough and Cummins 1988, 149); and a flake of Alpine jadeitite from High Peak was unstratified (S. Pollard 1966, 51–2; Pétrequin *et al.* 2006; 2008). The locations of these two finds, however, suggest that they too could date to the second quarter of the fourth millennium cal BC.

The Neolithic contexts of greenstone axeheads in the peninsula and Wessex have been well rehearsed (e.g. I. Smith 1979). At a local scale, the prevalence of Group XVI at Carn Brea, of Group XVII at Helman Tor and of Group IVa at Hembury almost certainly reflects the use of nearby resources. Group XVI is attributed to a source in the Camborne area, close to Carn Brea (I. Smith 1981), and one of the two postulated sources of Group XVII is close to Helman Tor (I. Smith 1997). The four examples of Group IVa from Hembury are ascribed to a group to which fewer than 20 implements have been attributed and the distribution of which is virtually confined to Devon and Dorset (Clough and Cummins 1988, map 5), so that the concentration at Hembury might suggest a local origin (A. Brown 1989, 47). These groups were all being exploited during the use of these enclosures, as were Group I, Group IV and ungrouped greenstones, examples of all of which were stratified in Neolithic contexts at Carn Brea and Helman Tor. It is difficult to find any pre-dating the 37th century cal BC, which is when Cornish greenstones began to be deposited further afield (see Chapter 14.5).

It thus seems that short- to medium-range networks were in place in the peninsula from at least the start of the 37th century cal BC, evidenced by nodular flint (which need have come from no farther away than Devon) at Tregarrick Farm and by gabbroic wares there and at Portscatho. Longer-range connections may have become usual over the following decades, when aggregation at enclosures would have fostered more diverse and farther-reaching contacts than before, corresponding to Cleal's inferred link (2004, 180) between the emergence of enclosures and the dispersal of gabbroic wares. The reality of some long-distance transport of objects before enclosures came into existence is reinforced, a little further afield, by the Alpine jadeitite axehead from the Sweet Track in the Somerset Levels, which was built in 3807/3806 BC and probably covered within around 30 years (Hillam *et al.* 1990, 218; Coles and Coles 1992; Chapter 4): thus deposited in the late 39th or earliest 38th century cal BC.

The Tregarrick Farm and Portscatho dates also help to define the currency of the South-Western style of Bowl pottery, which had certainly appeared by *c.* 3700 cal BC (and see Chapter 14.5). On the basis of its presence at sites in Wessex, it continued to be made and used into the third quarter of the fourth millennium cal BC. More local evidence of the later use of this fabric may be provided by the estimated end date for the use of Carn Brea (Fig. 10.25: *end Carn Brea*).

Did the South-Western style emerge or diverge from an earlier more widespread tradition, or was the ceramic tradition of the south-west distinct from the outset? In favour of the latter possibility at present might be the continuing low quantity of typologically early Bowl pottery in the south-west as a whole (cf. Herne 1988; Cleal 2004). There are, however, light-rimmed, carinated elements in the Carn Brea assemblage (I. Smith 1981, fig. 68) and, as noted above, there are small assemblages of this character at Broadsands, and perhaps at Long Range and Nymet Barton, in Devon, although none is yet known in Cornwall. Alison Sheridan considers the ultimate origins of South-Western forms and stylistic traits, including the trumpet lug, to lie in the Middle Neolithic ceramics of north-west France, but that these characteristics are already insular (Sheridan *et al.* 2008).

So this became a distinctive, connected world. But were its connections and exchange networks, and the social interactions that prompted them, fully in existence by the time that people began to build and use enclosures? With the chronological evidence reviewed in this chapter, we now have to grapple with two competing possibilities. The first is that existing, shared materialities could have been in part the precondition for the existence of enclosures, and the evidence of this region in particular is potentially of exceptional importance in this regard, given our ability to identify the sources of clays and stone types and to track some of their movements. On a general reading of the evidence, connections might have been formed and extended quite rapidly in the 38th century cal BC, a process in its own way at least as significant as the appearance of the enclosures themselves. But the second possibility is that enclosures brought that connectedness into existence during the 37th century cal BC, or were part and parcel of a burgeoning phase of more intense social interaction. The same social conditions surrounding the initial use and development of enclosures may have encouraged the extension of shared materialities and of exchange networks, and *vice versa*, as also explored for south Wessex in Chapter 4. On closer reading of the available dating evidence, while we can see a south-western Neolithic in existence by the 38th century cal BC, we cannot yet demonstrate that either gabbroic pottery or Cornish axes were on the move before the start of the 37th century cal BC (discussed further in Chapters 14 and 15). The existence of long-distance exchange networks before this date is, however, demonstrated by the Sweet Track jadeitite axe, probably deposited in the early 38th century cal BC too. On present evidence, however, we incline to see the expansion of exchange networks beyond the south-west as part of the same phenomenon as the enclosures themselves.

In more general terms, we could also widen the notion of connections to linkage between different spheres, domains or fields of thought. This has already been suggested

between tors and portal dolmens, and between the Roche Rock and the Tregarrick Farm occupation (R. Bradley 1998b; Tilley and Bennett 2001; Cole and Jones 2003). The form of tor enclosures themselves involved connecting outcrops with stone walling. So there was a nexus between the ground or the earth, detachable rocks or stones, rock outcrops, material culture and people, which was part of the worldview of people from the 38th into the 37th and 36th centuries cal BC in the south-west peninsula; and for West Penwith at least in the extreme south-west, though beyond the known distribution of enclosures, it has been suggested that this was played out against the backdrop of the drama of the rising and setting sun, symbolic of themes of life and death (Tilley and Bennett 2001).

We must also recognise, however, that such a putative worldview embracing connections of various kinds, material and conceptual, performed and imagined, also contained a very different kind of social interaction: inter-personal if not inter-group violence. Indeed the evidence from the eastern summit at Carn Brea and from both inner and outer ditches at Hembury strongly argues for an inter-group scale of violent encounter (and see Chapters 14.2 and 15.8).

Aftermath

What, finally, came after the ditched and walled enclosures in the south-west? It is notable that Hembury, Raddon and Carn Brea (on the basis of its outer rampart) have Iron Age forts over or very close to them, but no features of intervening date, although there is a Late Bronze Age hoard from Carn Brea (Mercer 1981a, 14, pl. I). We do not know if any of the stone circles and even henges in the south-west could date as early as the latter part of the fourth millennium cal BC; on grounds of general comparison with other areas, this seems unlikely at present. Do entrance graves belong here? There are few candidates for cursus monuments in the south-west, among them an aligned cropmark cursus and oblong ditch at Nether Exe (Griffith 1994, pl. 2). In Cornwall, possible cursus monuments have been identified from aerial photographs at Triffle and on the Roseland peninsula (Andy M. Jones, pers. comm.). A massive bank cairn on the slopes of Rough Tor could also date to this period (Herring and Kirkham forthcoming).

Are the rectilinear enclosures in east Devon revealed by the A30 roadworks at Castle Hill, and known as cropmarks at North Tawton (Fitzpatrick *et al.* 1999, 18–68; Griffith 1985), features of a post-enclosure world? The two monuments on Castle Hill are poorly dated. There is a possible sequence of two measurements from enclosure 219 (Fig. 10.32: Beta-78183, AA-30670), the earlier one on a bulk short-life charcoal sample from a single fill and the later one on an unidentified bulk charcoal sample from a secondary fill in another part of the ditch. If neither included redeposited, intrusive or mature charcoal, they could point to a mid- to late fourth millennium construction date, which would be compatible with the presence of Peterborough Ware in the other, undated enclosure (Fitzpatrick *et al.* 1999, 24, 63). Much basic research still remains to be done.

Notes

1 The model shown in Figure 10.30 was constructed on the basis of a draft of the paper published by Sheridan *et al*. in 2008, although the text was finalised after that publication. It was not clear when the model was built that OxA-12739 and -17979 had been measured on the same bone, and they have consequently been included in the model separately. If a weighted mean is taken of these two measurements before its inclusion in the model (even though the measurements are not statistically consistent at 95% confidence; Table 10.5), the estimated start and end dates for the primary phase of Broadsands in the context of the model defined in Fig. 10.30 are *3840–3710 cal BC* (*95% probability*; *start broadsands*; model not shown) or *3805–3735 cal BC* (*68% probability*) and *3785–3555 cal BC* (*95% probability*; *end broadsands*; model not shown) or *3770–3675 cal BC* (*68% probability*).

2 Since this chapter was written, two samples of cremated bone have been dated from portal dolmens in Cornwall: Zennor and Sperris Quoits (Kytmannow 2008, table 7.1). At Zennor Quoit, a fragment from the eastern half of the main chamber produced a date of 3350–3010 cal BC (95% confidence; UB-6753; 4471±38 BP). At Sperris Quoit, a fragment of bone from a small pit just outside the chamber provided a date of 3640–3370 cal BC (95% confidence; UB-6754; 4712±39 BP).

3 Although the balance of evidence favours the second millennium cal BC (Jones and Thomas 2010).

Gathering Time

Dating the Early Neolithic Enclosures of Southern Britain and Ireland

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Volume 2

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With contributions by

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Contents

VOLUME II

11 The Marches, south Wales and the Isle of Man

Alex Bayliss, Alasdair Whittle, Frances Healy, Keith Ray, Peter Dorling, Richard Lewis, Timothy Darvill, Geoffrey Wainwright and Michael Wysocki

The area covered in this chapter (Fig. 11.1) ranges from the west Midlands to the Preseli Hills in south-west Wales. It encompasses the low-lying areas of the Avon, Severn and Wye valleys and the south-east Welsh coast, all of them rich in prehistoric settlement, as well as the uplands to the north and west, where stone-built monuments are often well preserved. Neolithic enclosures currently seem markedly less numerous in the Marches and south and west Wales than in southern England (Fig. 1.1), although this may change with future research, as more enclosures of all kinds are recognised as Neolithic. We also consider one site, Billown, in the south of the Isle of Man.

Research histories have been varied, although much of the fieldwork has been quite recent. Hill Croft Field, in Herefordshire, was discovered from aerial photographs in 2006 and evaluated in the course of a broader assessment of the Lugg valley. Aerial photography in 2006 revealed a double-ditched causewayed enclosure at Womaston in the Walton basin, Powys (Chris Musson, pers. comm.; Toby Driver, pers. comm.), extending the history of a monument complex in which the earliest component had previously seemed to be a cursus (Gibson 1999); preliminary excavation followed in 2008.[1] The earthworks at Beech Court Farm, in the Vale of Glamorgan, were already known, although relocated by aerial photography in 1988, and were investigated from 1999 in advance of limestone quarrying. Banc Du, in Pembrokeshire, was first identified by aerial photography in 1990, photographed again under better conditions in 2002, and investigated through field evaluation as part of a research project on ancient communities in the Strumble-Preseli area. Billown, on the Isle of Man, was discovered in 1995 through quarrying and geophysical survey.

Several other probably and possibly Neolithic enclosures are known, including earth- and stone-built segmented earthworks on Dorstone Hill, Herefordshire, which have yielded early Neolithic material (Oswald *et al.* 2001, fig. 4.13; Pye 1967; 1968; 1969) and a possible causewayed site at Woolston, near Oswestry in Shropshire, known through aerial photography since 1971 (Oswald *et al*. 2001, 154). The rate of recent discoveries suggests that many more could remain to be discovered across the area. Three further sites are suspected on hilltops in Herefordshire, one close to Hereford and two to the north-east of the Black Mountains. In south-east Wales, two probably Neolithic enclosures with interrupted ditches have been recognised by aerial photography at Corntown and Norton, both in the Ogmore valley. The surface of the Corntown site yielded a lithic collection including 30 leaf arrowheads (Burrow *et al.* 2001), and evaluation of the Norton enclosure in 2006 established the presence of two ditches and recovered a considerable amount of animal and possibly human bone from a back-filled basal deposit. Diagnostic artefacts were absent and radiocarbon dates are awaited (Richard Lewis, pers. comm.). A third possible site, with a layout like the Corntown example, made up of two close-set, concentric interrupted ditches and a third, incomplete circuit some way outside them, was seen from the air some 12 km to the south-east in the summer drought of 2006 at Flemingston, near St Athan, in the Vale of Glamorgan (Toby Driver, pers. comm.; Pitts 2006).

11.1 Hill Croft Field, Bodenham, Herefordshire, SO 5405 4995

Location and topography

The enclosure in Hill Croft Field lies at 112 m OD, surrounding a natural knoll on the end of a small ridge above the Lugg valley, surrounded by ranges of hills, all visible from the enclosure (Fig. 11.1). The area of the entrance is on Bishop's Frome Limestone, while most of the enclosure is on the Raglan Mudstone Formation, both parts of the Lower Old Red Sandstone system. The solid geology is overlain by glacial clays. The Lugg and other small streams rise in the hills to the north and then run south to join the Wye.

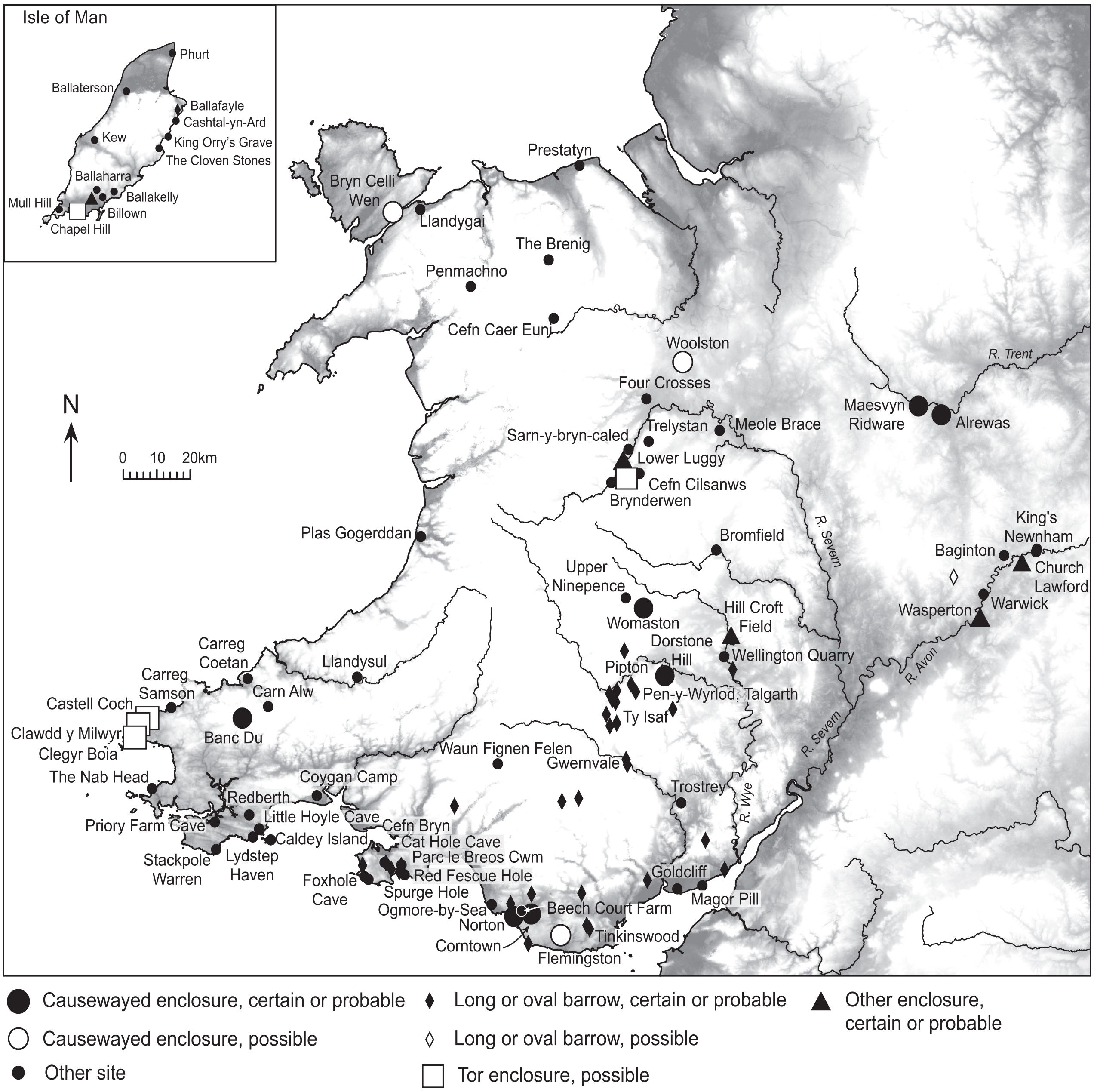

Fig. 11.1. Wales, the Marches and adjoining parts of the Cotswolds and North Wiltshire, showing causewayed enclosures, long barrows and cairns and other sites mentioned in Chapter 11. The Isle of Man is shown as an inset.

History of investigation

The site was first recognised from the vertical aerial photographic coverage (taken in 2001) in the county GIS in 2006, as an ovoid ditched enclosure, *c.* 180 m in maximum dimension, with one apparent entrance to the north. It was investigated by Herefordshire Archaeology as part of the Lugg Valley Archaeology, Landscape Change and Conservation Project, which was partly funded by the European Union and DEFRA through the Herefordshire Rivers LEADER+ Programme and English Heritage. Selective geophysical survey led to test excavation in three trenches. Two encountered no significant archaeology. A third trench, 10 m by 5 m, was positioned to investigate the entrance and located two terminals, 4.50 m apart, one of which was excavated (Fig. 11.2). Here the ditch was 3.30 m wide and 0.85 m deep. A primary fill of red-brown silty clay (context 30) contained plain Neolithic Bowl pottery with struck flint, animal and human bone, and numerous snail shells. Above this, compact silts and clays appeared to have been backfilled from the inside of the ditch, followed by a layer of silt with charcoal flecks. This in turn was overlain by a band of charcoal (context 23), and then a mixed, substantial upper fill.

Objectives of the dating programme

The main aim was to confirm and refine the Neolithic date indicated by the artefacts.

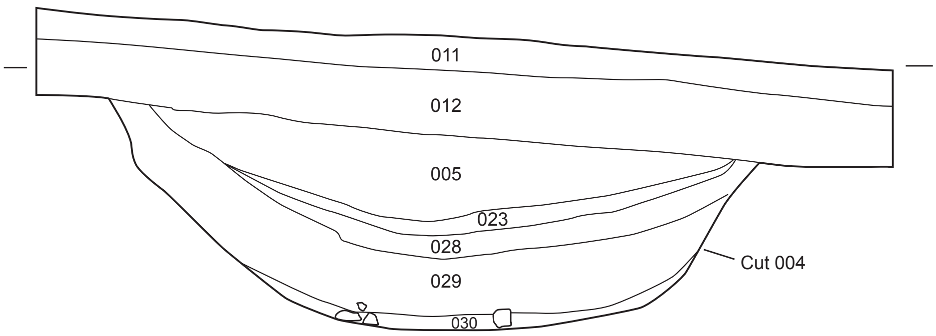

Fig. 11.2. Hill Croft Field. Section through the enclosure ditch. Herefordshire Archaeology.

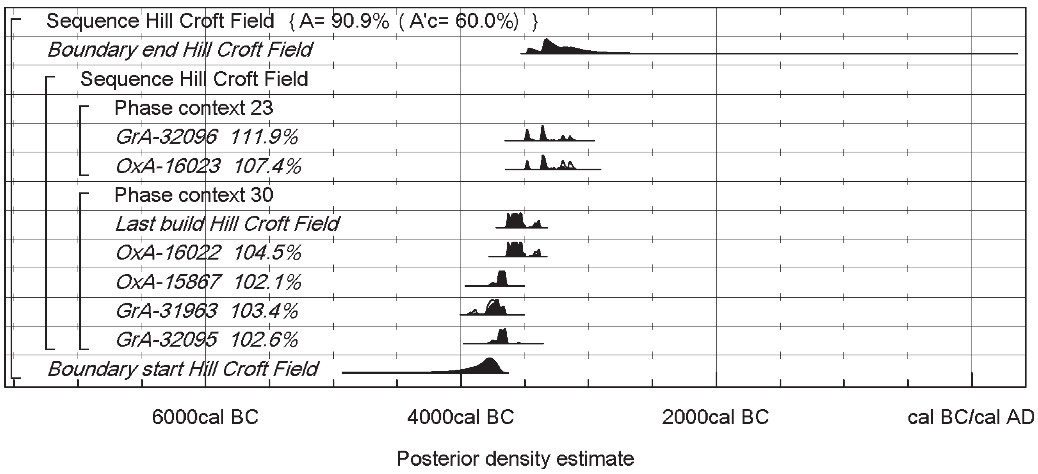

Fig. 11.3. Hill Croft Field. Probability distributions of dates from the enclosure. Each distribution represents the relative probability that an event occurred at a particular time. For each of the dates two distributions have been plotted, one in outline which is the result produced by the scientific evidence alone, and a solid one which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution 'start Hill Croft Field' is the estimated date for the start of Neolithic activity on the site. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Sampling

Samples were restricted to disarticulated human and animal bone and scattered short-life charcoal from the lowest layer (context 30) and to short-life charcoal from the band of charcoal (context 23).

Results and calibration

Full details of the results are shown in Table 11.1.

Analysis and interpretation

A chronological model is shown in Fig. 11.3. Four samples from context 30 provided statistically inconsistent radiocarbon determinations (T'=16.3; T'(5%)=7.8; ν=3). Since all these samples were of disarticulated bone or scattered charcoal, the latest of them provides the best estimate for construction, in *3640–3500 cal BC* (*92% probability*; Fig. 11.3: *build Hill Croft Field*) or *3415–3380 cal BC* (*3% probability*), probably in *3635–3620 cal BC* (*9% probability*) or *3605–3520 cal BC* (*59% probability*). The two bone samples are older than the two charcoal samples. However, since the two measurements on charcoal samples are themselves statistically inconsistent (T'=6.0; T'(5%)=3.8; ν=1), it seems that this context contained redeposited material, with the connotation of previous Neolithic activity in the area.

Context 23 yielded two statistically consistent measurements on single fragments of oak sapwood charcoal (T'=0.1; T'(5%)=3.8; ν=1). This band of charred material was separated from context 30 by apparent backfill followed by silting. A century or two may have intervened before context 23 was deposited in the later fourth millennium (Fig. 11.3).

Implications

The mid-fourth millennium cal BC date of the monument confirms that in this region, as in others, enclosures of the period included forms other than the readily recognised causewayed plans of, for example, Dorstone Hill or Womaston. Now that the date of the site is established,

Table 11.1 Radiocarbon dates from Hill Croft Field, Herefordshire. Posterior density estimates derive from the model defined in Fig. 11.3.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-32095	HC06 30/C	Single fragment *Corylus* sp. charcoal	Trench 1, feature 4, context 30. On base of ditch, in thin layer of silt sealed by apparent backfill, scattered in deposit of sherds, probably from one pot, and human and animal bone with numerous macroscopic snail shells clustered around bones	4895±40	−26.1	3770–3630	*3765–3635*
OxA-16022	HC06 30/A	Single fragment *Prunus* sp. charcoal	From the same context as GrA-32095	4762±37	−26.0	3640–3370	*3640–3500* (*92%*) or *3415–3380* (*3%*)
OxA-15867	HC06 30/B	Human. From robust R femur shaft fragment, weighing 114 g	From the same context as GrA-32095	4911±29	−19.5	3760–3640	*3760–3740* (*4%*) or *3735–3720* (*2%*) or *3715–3640* (*89%*)
GrA-31963	HC06 30/D	Cattle. From distal R femur fragment weighing 173 g	From the same context as GrA-32095	4970±40	−22.5	3930–3650	*3805–3650*
GrA-32096	HC06 23/A	Single fragment *Quercus* sp. sapwood charcoal	Trench 1, feature 4, context 23. Charcoal lens, not burnt *in situ*, above apparent backfill sealing context 30 and above subsequent silt	4585±35	−23.9	3500–3120	*3505–3425* (*36%*) or *3380–3315* (*49%*) or *3220–3175* (*6%*) or *3160–3120* (*4%*)
OxA-16023	HC06 23/B	Single fragment *Quercus* sp. sapwood charcoal	From the same context as GrA-32096	4568±35	−23.3	3490–3110	*3500–3445* (*22%*) or *3380–3280* (*55%*) or *3275–3260* (*1%*) or *3240–3170* (*11%*) or *3160–3120* (*6%*)

its roles and functions call for elucidation by further investigation.

11.2 Beech Court Farm, Ewenny, Vale of Glamorgan, SS 9040 7660

Location and topography

The enclosure at Beech Court Farm lies at 84 m OD at the west end of the Vale of Glamorgan, encircling a low rise, to the south and west of which the ground drops sharply to the valley of the Afon Alun, one of several rivers running into the sea close by (Fig. 11.1).

History of investigation

Earthworks on the site were first noted by Rev. William Harris in 1773. Cyril and Aileen Fox noted additional earthworks in 1935, though a further visit in 1957 found none. A chance over-flight by RCHAMW in 1988 showed that the sub-circular enclosure was still visible from the air. Ground and geophysical survey from 1998 onwards, in advance of the threat of quarrying, established the presence of two circuits of ditch and bank, some 190 m across in maximum dimension (Fig. 11.4). According to survey, these circuits were incomplete, though the ditches were apparently continuous in long stretches; they were only doubled for one stretch on the east side. The inner bank was more extensive, with an overlapping entrance to the north-west and an outer bank roughly coinciding with the portion of observable outer ditch.

Test trenches showed that the inner ditch was up to 3.5 m across and under 1 m deep from the present surface; the outer ditch was of similar depth but as seen in the excavated portion very slightly narrower. Evaluation was followed by extensive excavation in 2002 of a substantial portion of the western part of the site then closest to the quarry. This showed that the single ditch here was discontinuous, with segments averaging 20 m long with enlarged terminals, and with a probable bank immediately on the inner side (Fig. 11.4). There were virtually no finds from the ditch segments. Very few features were found in the interior, though struck flint and other finds were recovered. A double posthole contained Collared Urn sherds.

Previous dating

A bulk sample of oak charcoal was dated by LSC at Beta Analytic Inc during the assessment (A. Caseldine *et al.* 2001), using methods described at http://radiocarbon.com/analytic.htm. The sample was recovered from a double posthole and may have derived from an oak post or posts burnt *in situ*. The section, however, perhaps suggests that this material was tipped in from the west. If this was the case, the sample may have included fragments of diverse ages and/or charcoal with a considerable age offset. The date would then provide a *terminus post quem* for its context. This date falls within the currency of Collared Urn pottery

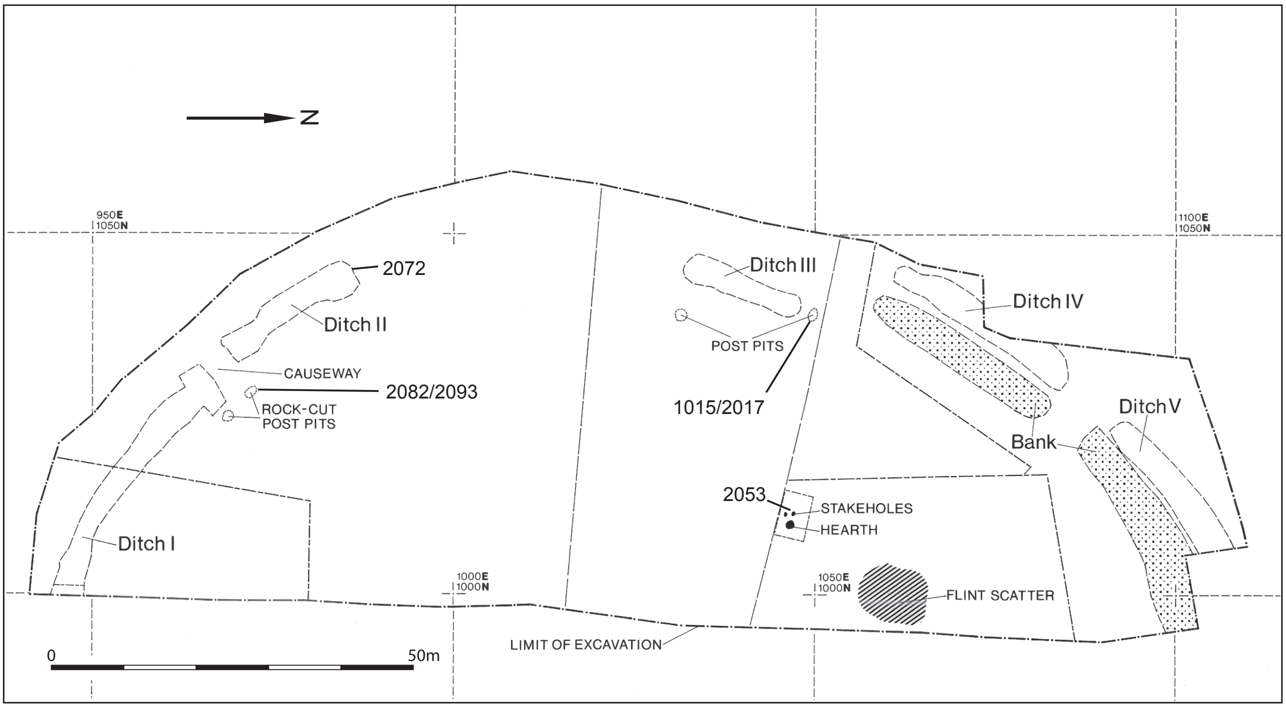

Fig. 11.4. Beech Court Farm, Ewenny. Plan of the excavated area. © GGAT 2003.

(Needham 1996), and sherds of this type were found within the feature. If the charcoal did derive from a post or posts, then, since the sockets were approximately 0.18 m in diameter, it may have derived from immature timber.

Objectives of the dating programme

This project aimed to determine whether the enclosure ditch was Neolithic. Further samples were submitted to determine the date of interior features.

Sampling

There was a severe shortage of datable material from the site. Bone was rarely preserved and there was no pottery in the ditch. One of two cattle molars from the base of the ditch was submitted for dating, the proximity of the two teeth suggesting that they may have been deposited as part of a jaw. Two single fragments of short-life charcoal were also submitted from an apparent dump of charcoal-rich material made in the butt of the same segment after some silt had accumulated.

In addition, Wessex Archaeology submitted samples from a stakehole associated with a hearth and from one of a pair of postholes framing a causeway.

Results and calibration

Full details of the five radiocarbon determinations from Beech Court Farm are provided in Table 11.2. The two samples processed at the Rafter Radiocarbon Laboratory, Lower Hutt, New Zealand, were dated by methods set out by Mook and Waterbolk (1985) and Zondervan *et al*. (2007).

Analysis and interpretation

A chronological model for the enclosure is shown in Fig. 11.5. Two episodes of activity are apparent, one in the early second millennium cal BC and one in the later first millennium cal BC.

Samples from the double posthole and from a stakehole adjacent to hearth 2047 produced statistically consistent measurements (T'=0.6; T'(5%)=3.8; ν=1), and suggest activity on the site in the Early Bronze Age (Fig. 11.5). The sample from one of the pair of postholes flanking a causeway in the enclosure was dated to *785–515 cal BC* (*95% probability*; Fig. 11.5: *NZA-21146*), although since it consisted of *Fraxinus* charcoal it may have an age offset of several centuries. Unfortunately, the cattle tooth from the base of the enclosure ditch contained no collagen and could not be dated. The two results from the charcoal fragments are in poor agreement with the stratigraphic sequence of the contexts from which these were recovered ($A_{overall}$=41.0%). It appears that GrA-27318 may be reworked from an earlier deposit, and so the best estimate for the date of the enclosure is provided by OxA-14142. This suggests that the enclosure was constructed in or before *195–50 cal BC* (*95% probability*; Fig. 11.5: *OxA-14142*), probably in or before *175–90 cal BC* (*66% probability*) or *70–60 cal BC* (*2% probability*).

Implications

This enclosure is not an early Neolithic one. This result may have considerable implications for our understanding and interpretation of other enclosures of similar form, which lack cultural material.

Table 11.2. Radiocarbon dates from Beech Court Farm, Ewenny, Vale of Glamorgan. Posterior density estimates derive from the model defined in Fig. 11.5.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Enclosure ditch							
GrA-27318	BCF sample 2016/A	Single fragment of *Prunus* sp. roundwood, charcoal	Ditch terminal 2072, lower-middle part of context 2085. In apparent dump of charcoal-rich material made in butt of segment after some silt had accumulated over the backfill covering BCF find 1578	2230±40	−25.5	400–190	*390–200*
OxA-14142	BCF sample 2019	Single fragment of *Prunus* sp. roundwood, charcoal	Ditch terminal 2072, context 2098. One of several charcoal fragments scattered in a layer (probably backfill) covering the base of the ditch, in the NW terminal of a ditch segment, beside an exceptionally large causeway, probably an entrance	2099±26	−25.0	200–40	*195–50*
Entrance							
NZA-21146	BCF sample 2009	*Fraxinus* charcoal, >1 fragment	Posthole 2082/2093. From unspecified layer in recut posthole at one side of entrance to enclosure. Only *Fraxinus* present, taken as remains of post	2500±30	−23.2	790–510	*785–515*
Beta-148233	BCF sample 1000	Bulk charcoal sample, mainly or entirely of *Quercus* sp.	Posthole 1015 in evaluation = posthole 2017 in subsequent excavation, context 1016. In postpipe which yielded 1 Early Bronze Age sherd. Since this was recovered from a double posthole, it may have derived from an oak post or posts burnt *in situ*. The section, however, shows a single fill without obvious postpipes and with scattered but dense charcoal fragments, perhaps tipped from the west	3490±60	−25.0 (assumed)	1960–1660	
Interior							
NZA-21145	BCF sample 2007	*Prunus* sp charcoal, >1 fragment	Stakehole 2053, layer 2054. Stakehole close to a hearth in interior of enclosure. Charcoal of >1 species present, thought to derive from hearth	3439±30	−24.5	1880–1680	

11.3 Banc Du, Casmael/Puncheston, Pembrokeshire, SN 0612 3065

Location and topography

The enclosure at Banc Du lies at *c*. 330 m OD on the south end of a ridge or promontory running from one of the series of rounded hills – Carn or Cerrig Lladron – which constitute the western part of the Preseli upland of south-west Wales (Fig. 11.1). There is a cragline to the south-east and steep sides to the south and west. The site overlooks the source of the Afon Syfynwy to the south-east and gives extensive views to south and west.

History of investigation

The site was discovered by Chris Musson during RCAHMW aerial reconnaissance in 1990, but at the time it was covered by scrub vegetation which obscured its unusual character. Further photography by Toby Driver of RCAHMW in December 2002 in better conditions prompted surface checking which revealed the presence of earthworks (Fig. 11.6). It appears to have been built against a steep ridge or cragline to the east. There is an inner earthwork, defining an area *c*. 200 m by 150 m with stretches of detectable bank and external ditch, in both of which interruptions can be seen (Darvill *et al*. 2003). On the south side, the line of earthworks is doubled, and this double earthwork continues from the west side clockwise round to the north-west, going on to the north-east again as a single line; further interruptions are visible, especially in one portion of the single earthwork to the south-east and in one stretch of the doubled earthwork to the north-west (Darvill *et al*. 2003; 2007a; 2007b). The outer earthwork defines an overall area some 300 m by 230 m.

Field evaluation involving geophysical and topographic surveys was undertaken as part of the Strumble-Preseli Ancient Communities and Environment Study (SPACES) in 2003, and a single cutting 1 m wide was made across the north side of the inner circuit in 2005 (Fig. 11.6; Darvill *et al*. 2006, 22–3; 2007a). It revealed a low earth and stone bank, some 4 m wide (Fig. 11.7). This had a large slate slab at its inner edge, a large stone at its outer face, and two substantial postholes some 2 m back from the outer face. Directly outside this apparently timber-framed bank or rampart, there was a large ditch of rounded V-profile, over 2.5 m wide and *c*. 1 m deep. This had a series of stony fills, seemingly naturally deposited, some of them rich in charred plant material.

Objectives of the dating programme

This project aimed to determine the date of the enclosure, in the light of suggestions that the segmented earthwork could be Neolithic.

Sampling

The local geological conditions are such that unburnt bone

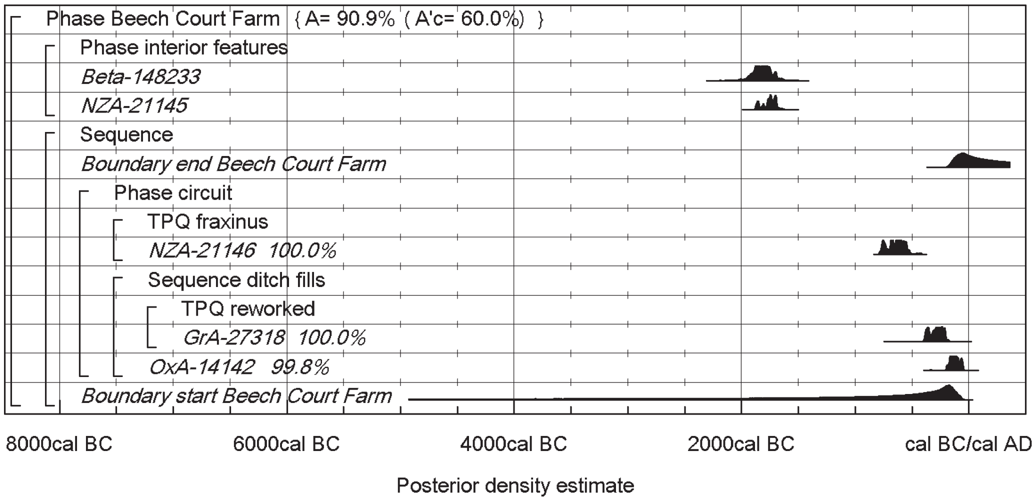

Fig. 11.5. Beech Court Farm. Probability distributions of dates. The format is identical to that of Fig. 11.3. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

would not have survived had it been present. There were no finds apart from charcoal and charred plant remains. Short-life samples of charred plant material were dated from three concentrations in the ditch fills.

Results and calibration

Full details of the radiocarbon measurements are given in Table 11.3.

Analysis and interpretation

A model for the chronology of the enclosure is shown in Fig. 11.8.

Two fragments of short-life material were dated from the primary fill of the ditch (context 21). These provided statistically inconsistent measurements (GrA-32006–7; T'=4.3; T'(5%)=3.8; ν=1), although this difference is sufficiently subtle that it may simply be that one of the measurements is a statistical outlier. Above context 21, a substantial recut can be suggested. Two samples were dated from what appears to be the third layer within this recut (context 18) and provided statistically consistent radiocarbon measurements (GrA-32008, -31099; T'=0.7; T'(5%)=3.8; ν=1). Towards the middle of the recut two samples were dated from another concentration of charred plant remains (context 15). Statistically consistent results were also obtained from this deposit (GrA-31186–7; T'=0.5; T'(5%)=3.8; ν=1).

The chronology suggested from this series of samples, and on the basis of such selective excavation so far, can only be tentative. The available data, however, suggest that the ditch was cut in *3645–3490 cal BC* (*84% probability*; Fig. 11.8: *build Banc Du*) or *3470–3400 cal BC* (*11% probability*), probably in *3640–3620 cal BC* (*7% probability*) or *3610–3515 cal BC* (*61% probability*).

There may have been a significant gap between the original construction of the earthwork and the recut. This may have lasted *80–570 years* (*95% probability*; distribution not shown), and possibly for several centuries (*195–215 years at 2% probability* or *280–530 years at 66% probability*). Although there were several layers between the base of the recut and the lowest dated fill within it, a preliminary indication of the date of the recut may be obtained from the earlier material in context 18. This suggests that the recut dates to *3340–3205 cal BC* (*21% probability*; Fig. 11.8: *Banc Du recut?*) or *3195–3150 cal BC* (*5% probability*) or *3140–2905 cal BC* (*69% probability*), probably to *3310–3300 cal BC* (*1% probability*) or *3265–3240 cal BC* (*5% probability*) or *3105–2915 cal BC* (*62% probability*). The sequence of fills in the recut continued into the first half of the third millennium cal BC (Fig. 11.8).

Implications for the site

The fact that a search for short-life charcoal samples yielded Ericaceae from the fills of the recut but not from the initial fill suggests that heathland may have become established in the area during the third quarter of the fourth millennium cal BC.

11.4 The Marches and South Wales: discussion

A later Mesolithic presence, defined by narrow-blade industries and various associated microlith forms, can be widely documented in Wales, and extends into the English side of the Marches, perhaps best documented in the Forest of Dean and on the lower Wye (Darvill 2006). The better published Welsh material shows a broad distribution, from coasts to lowlands and uplands (Jacobi 1980; David and Walker 2004, fig. 17. 11; Olding 2000, fig. 3; Bell 2007a; 2007b). Clusters of sites, for example on the coast in Pembrokeshire or in the Glamorgan uplands, may reflect unusual archaeological visibility and concentrations of local collectors, so that we cannot claim to have anything

Table 11.3. Radiocarbon dates from Banc Du, Pembrokeshire. Posterior density estimates derive from the model defined in Fig. 11.8.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
GrA-31187	BDE 05 ES <1> (b)	Single fragment Ericaceae charcoal	F1, Context 15. Upper of two layers rich in charred material (the lower being context 18) within a possible recut, stratified above context 18	4085±35	−26.9	2860–2490	*2865–2805 (27%)* or *2760–2715 (9%)* or *2710–2560 (55%)* or *2525–2495 (4%)*
GrA-31186	BDE 05 ES <1> (a)	Single fragment Ericaceae charcoal	From the same context as GrA-31187	4120±35	−28.2	2880–2570	*2875–2800 (30%)* or *2780–2575 (65%)*
GrA-32008	BDE 05 ES <12> (c)	Single fragment Ericaceae charcoal	F1, Context 18. Lower of two layers rich in charred material (the upper being context 15) within a possible recut, stratified above context 21	4390±80	−26.6	3350–2880	*3340–3205 (21%)* or *3195–3145 (6%)* or *3140–2890 (68%)*
GrA-31099	BDE 05 ES <12> (a)	Single fragment Ericaceae charcoal	From the same context as GrA-32008	4315±40	−26.3	3030–2880	*3025–2880*
GrA-32007	BDE 05 ES <14> (d)	Single fragment unidentified bark charcoal	F1, Context 21. Initial silt on floor of ditch, stratified below contexts 15 and 18	4775±40	−27.5	3650–3380	*3645–3505 (80%)* or *3430–3375 (15%)*
GrA-32006	BDE 05 ES <14> (c)	Single fragment *Quercus* sapwood charcoal	From the same context as GrA-32007	4665±35	−23.3	3630–3360	*3620–3610 (1%)* or *3525–3360 (94%)*

like the full picture. A wide range of site types can be envisaged. The sourcing of lithic raw materials suggests that territories embraced both coastal and inland landscapes, as at the repeatedly visited lakeside site of Waun Fignen Felen on the Black Mountain. Here, beach pebble flint, from at least 30 km away, and Greensand chert, from a distance of at least 80 km, were abundant in the early Mesolithic, and had in many cases been brought to the area as complete, unworked pebbles or nodules, suggesting frequent movement between upland and coast (Barton *et al.* 1995, 89–92, 105–7). Farther east, late Mesolithic assemblages from cave and rock shelter sites in the Wye valley, some 25 km inland from the Severn estuary, include imported flint and perforated cowrie shells (Barton and Roberts 2004, 352–3).

Figure 11.9 presents dates from the fifth millennium cal BC and the latter part of the Mesolithic sequence in south Wales. At Lydstep Haven, Pembrokeshire (Leach 1918; Jacobi 1980, 175; David and Walker 2004), a date of 4350–3940 cal BC (95% confidence; Fig. 11.9; Table 11.4: OxA-1412) was obtained on an articulated pig skeleton found in 1917 in foreshore peats with two broken rod microliths immediately above its neck vertebrae. This animal appears to be the prey of a late Mesolithic hunting episode; speculation that it could have been domesticated (M. Lewis 1992) has not been supported so far by further analysis.

At Goldcliff, Monmouthshire, on the inter-tidal foreshore of the Caldicot Levels on the north side of the upper Severn estuary, a later Mesolithic occupation west of Goldcliff Island resulted in the formation of a layer, in places more than 0.25 m thick and extending over at least 17 m by up to 8 m (Bell *et al.* 2000, figs 4.4–5). Spreads of charcoal, animal bone including dog, otter, red and roe deer, bird bone and fish bone, were characteristic. Lithics included waste from narrow blade production and there were a few microliths, including a scalene triangle (Barton 2000). Four other radiocarbon determinations (Bell *et al*. 2000; David and Walker 2004, fig. 17.12; not listed in Table 11.4 here) suggest that this activity goes back to the sixth millennium cal BC. A hazelnut from the surface of this deposit, however, provides a radiocarbon date of 4440–4040 cal BC (95% confidence; Fig. 11.9; Table 11.4: OxA-6682). East of Goldcliff Island, further work on comparable occupations has produced dates from sites A and B going back again to the sixth millennium cal BC (Bell 2007b, table 8.2). From Site J, an area of Holocene soil preserved beneath estuarine silt and peat, there was a concentration of heat-fractured stone, animal bone, including deer, aurochs and pig, some smashed and burnt and some cut-marked, and late Mesolithic lithics (Bell *et al.* 2003, 7–12; Bell 2007b, 68, 109–112, figs 6.8, 6.16). There are two dates for wooden artefacts, one from the palaeosol (95% confidence; 4940–4710 cal BC; Fig. 11.9; Table 11.4: OxA-15549), and another from the interface of the overlying estuarine clay and the peat which grew above it (95% confidence; 4910–4710 cal BC; Fig. 11.9: OxA-15550). A series of radiocarbon determinations from one location, where silts

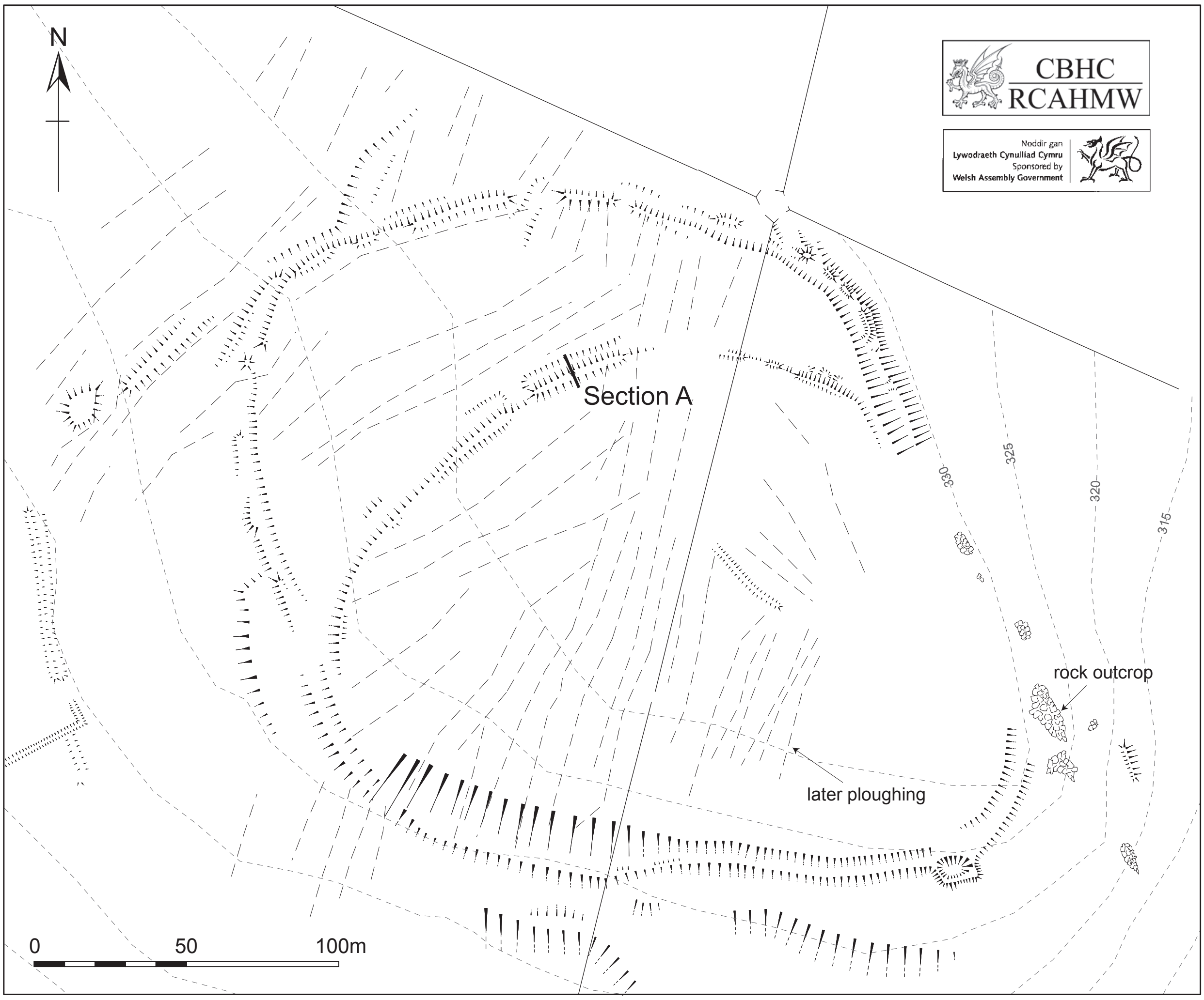

Fig. 11.6. Banc Du. Plan showing location of excavation trench. Crown copyright: Royal Commission on the Ancient and Historical Monuments of Wales.

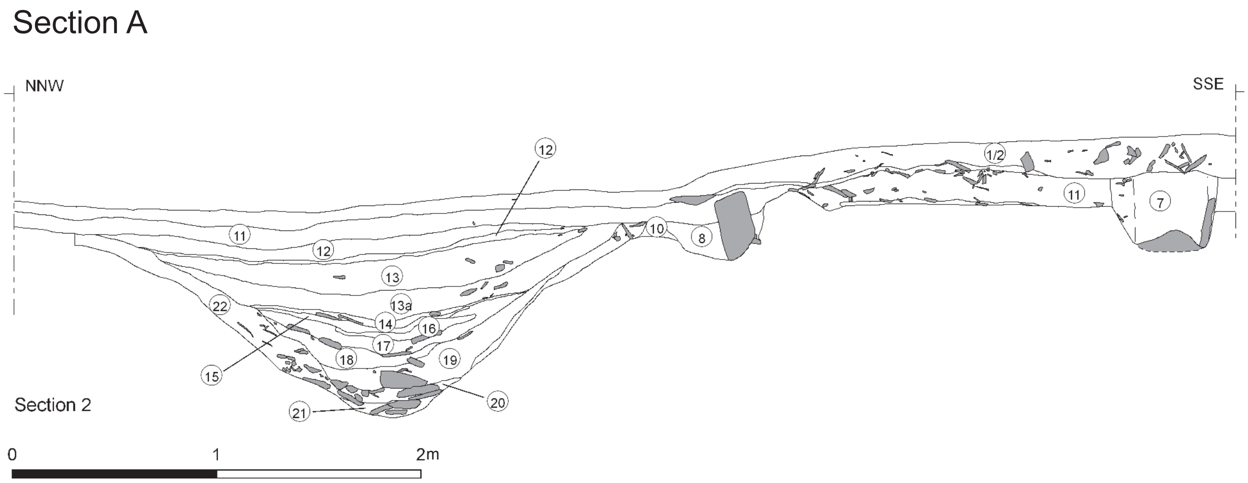

Fig. 11.7. Banc Du. Section showing ditch stratigraphy and bank revetment. SPACES project.

had been deposited before peat growth began (Table 11.4: OxA-13934, -12356, -13933, -13520, -13932, -12355), produced an environmental sequence running from the second quarter of the fifth millennium cal BC to the first quarter of the fourth millennium cal BC. These dates do not, however, refine the date of the Mesolithic occupation in the underlying palaeosol. A single date from the base of the peat at another location, where the peat directly overlay

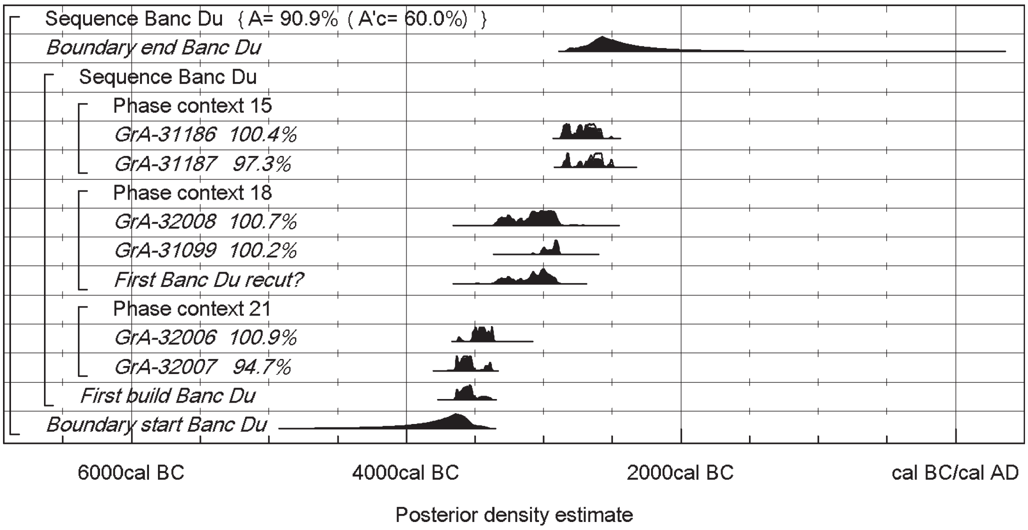

Fig. 11.8. Banc Du. Probability distributions of dates. The format is identical to that of Fig. 11.3. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

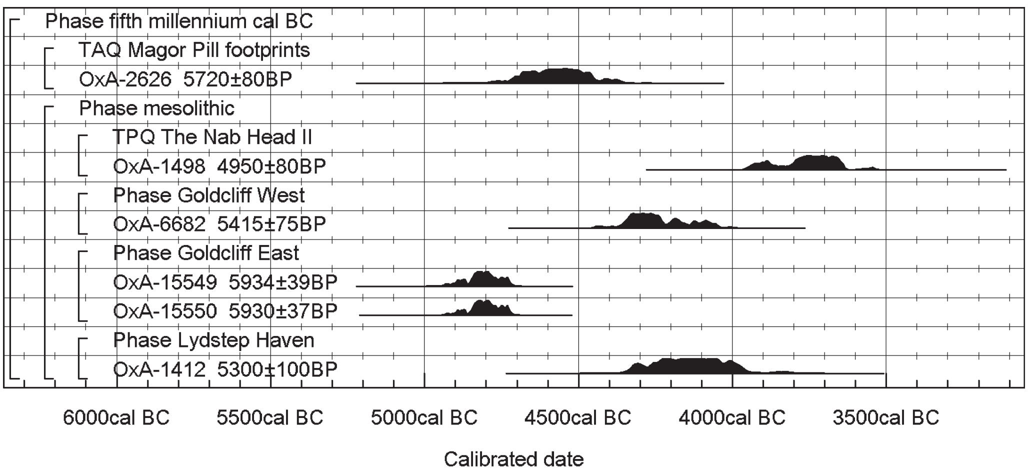

Fig. 11.9. South Wales. Probability distributions of calibrated radiocarbon dates (Stuiver and Reimer 1993) associated with late Mesolithic material or falling in the fifth millennium cal BC.

the palaeosol (Table 11.4: OxA-14023) falls in the earlier part of the fourth millennium cal BC.

The Nab Head, Pembrokeshire, has been one of the best documented coastal locations in south-west Wales (David 1989; 1990; David and Walker 2004). On site II there was a probable hearth area, with concentrations of material including debitage (some refitting), microliths dominated by narrow scalene triangles, a range of other retouched forms, and bevelled pebbles (David 1990, fig. 6.11). Despite their technological homogeneity, these accumulations may be the result of repeat visits, and three radiocarbon determinations (Table 11.4: OxA-860–1, and -1497; David and Walker 2004, fig. 17.12) suggest that this activity may have extended over a long period from the eighth or seventh to the fifth millennia cal BC. In a test trench beyond the main area a single fragment of *Quercus* charcoal from the base of a shallow soil, from which scalene triangles and refitting bladelet cores and debitage were also recovered, provided a date of 3960–3530 cal BC (95% confidence; Fig. 11.9: OxA-1498). It is unclear whether this sample is reliably associated with the flintwork, although no diagnostic Neolithic material was recovered from that trench (David 1990).

Figure 11.9 also shows the radiocarbon date (Fig. 11.9: OxA-2626) for peat overlying a trail of human footprints at Magor Pill, Monmouthshire, also on the inter-tidal foreshore of the upper Severn estuary. Since the footprints are not eroded, the deposits containing them were presumably fast-forming (Aldhouse-Green *et al*. 1992), and further fifth millennium cal BC activity is indicated, although the identity of the people in question cannot be directly determined since there is no associated cultural material.

It is worth noting Mesolithic sites in north Wales (Bell 2007b; Burrow 2006a, 9), though we have not modelled radiocarbon dates from any of them. The shell middens at Prestatyn had few stratified artefacts. Radiocarbon measurements on charcoal from site D at Nant Hall Road

Table 11.4. Radiocarbon dates from the Marches and Wales. Posterior density estimates derive from the models defined in Figs 11.10–11, 11.15 and 11.18–19.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Lydstep Haven, Pembrokeshire								
OxA-1412	1970–3063	Pig. Bone	Articulated pig skeleton found in 1917 in foreshore peats with two broken rod microliths immediately above its neck vertebrae, apparently lodged in its neck when it died, and overlain by a fallen tree trunk (Leach 1918; Jacobi 1980, figs 4.25–6, pl. 4.V)	5300±100	−21.0		4350–3940	
Goldcliff West, Monmouthshire								
OxA-6682	4208	Hazelnut	From context 1202 , the surface of the late Mesolithic occupation layer exposed on the present inter-tidal foreshore of the Caldicot Levels in the upper Severn estuary (R. Hedges *et al*. 1998, 236; Bell *et al*. 2000, 37, figs 4.4–5)	5415±75	−23.3		4440–4040	
Goldcliff East, Monmouthshire								
OxA-15549	9199	Worked wood, unidentified species	Goldcliff J. Context 328 from palaeosol containing abundant late Mesolithic assemblage (almost all flint rather than chert), including geometric microliths, bones of deer, aurochs and pig, and a small amount of fish bone (Bell 2007b, 68, 109–112, table 8.11, figs 6.8, 6.16)	5934±39	−25.2		4940–4710	
OxA-15550	9224	Worked piece of *Quercus*	Goldcliff J. Context 331/327 at interface of estuarine clay (331) overlying palaeosol (328) and overlying upper peat (327), both containing technologically Mesolithic lithics (mainly chert in 331, flint in 327); bones of deer and pig in silt, of deer in peat (Bell 2007b, 69, 112, table 8.11, figs 6.8, 6.16)	5930±37	−25.7		4910–4710	
OxA-13934	5125/91	Waterlogged *Carex* fragment	Goldcliff J. Context 362. Pit J, monolith 5125. Thin reed peat overlying 331 and underlying 327. From sequence of samples through upper peat, stratified below OxA-12356 (Bell 2007b, table 8.2, fig. 6.8)	5730±33	−25.9		4690–4480	
OxA-12356	5125/82	Reed peat	Goldcliff J. Context 327. Pit J, monolith 5125. From sequence of samples through upper peat, overlying 331/327, stratified above OxA-13934 and below OxA-13933 (Bell 2007b, table 8.2, fig. 6.8)	5749± 23	−28.1		4690–4525	
OxA-13933	5125/50	Waterlogged *Rubus* seeds	Goldcliff J. Context 327. Pit J, monolith 5125. From sequence of samples through upper peat, overlying 331/327, stratified above OxA-12356 and below OxA-13520 (Bell 2007b, table 8.2, fig. 6.8)	5439±22	−29.8		4345–4255	
OxA-13520	5125/41	Waterlogged *Betula* seeds	Goldcliff J. Context 327. Pit J, monolith 5125. From sequence of samples through upper peat, overlying 331/327, stratified above OxA-13933 and below OxA-13932 (Bell 2007b, table 8.2, fig. 6.8)	5213±23	−26.4		4050–3965	

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
OxA-13932	5125/34	Waterlogged *Alnus* catkin	Goldcliff J. Context 327. Pit J, monolith 5125. From sequence of samples through upper peat, overlying 331/327, stratified above OxA-13520 and below OxA-12355 (Bell 2007b, table 8.2, fig. 6.8)	5138±31	−27.9		3990–3810	
OxA-12355	5125/4	Peat/waterlogged wood	Goldcliff J. Context 327. Pit J, monolith 5125. From sequence of samples through upper peat, overlying 331/327, stratified above OxA-13932 (Bell 2007b, table 8.2, fig. 6.8)	5061±21	−29.3		3955–3785	
OxA-14023	5640/26	Charcoal	Goldcliff J. Context 327. Monolith 5640. From base of upper peat, overlying 328 (Bell 2007b, table 8.2, fig. 6.9)	4978±27	−26.7		3900–3690	
The Nab Head II, Pembrokeshire								
OxA-860	106	Unidentified charcoal fragments	Shallow pit in concentration of later Mesolithic artefacts, including numerous geometric microliths, in 0.10 m deep zone at base of soil profile (David 1989, 245–51; David 1990, ch. VI; Gowlett *et al.* 1987)	7360±90			6430–6030	
OxA-861	D9 NW	Single fragment of *Prunus* sp. charcoal	Hearth area in concentration of later Mesolithic artefacts, including numerous geometric microliths, at base of soil profile (David 1989, 245–51; David 1990, ch.VI; Gowlett *et al.* 1987)	6210±90			5370–4935	
OxA-1497	NH II 86 01	Single fragment of *Quercus* charcoal	From about 4.50 m SW of OxA-861 (David 1990, ch. VI; R. Hedges *et al.* 1989b)	8070±80	−26.0		7305–6695	
OxA-1498	NH II 86 02	Single fragment of *Quercus* charcoal	From a 2 m x 2 m test trench 14 m N of main excavation trench at the Nab Head Site II. Finds came from a very shallow soil (0.15–0.20 m) with a concentration of late Mesolithic flintwork, including bladelet cores, scalene triangles and debitage, some of which refits, as well as bevelled pebbles (David 1990, ch. VI; R. Hedges *et al.* 1989b)	4950±80	−26.0		3960–3530	
Magor Pill, Monmouthshire								
OxA-2626	MP/9.3.90	Peat	*Terminus ante quem* for human footprints stratified in deposits on the present inter-tidal foreshore (Aldhouse-Green *et al*. 1992)	5720±80	−26.5		4770–4360	
Nant Hall Road, Prestatyn, Denbighshire								
CAR-1424		Charcoal	Site D, context 24, soil layer just below shell midden (Bell 2007b, 272–75, figs 20.8–20.10)	5470±80			4460–4070	
CAR-1423		Charcoal	Site D, context 21, squares 32(lower) and 33. Midden on margin of wetland deposits, consisting mainly of mussel shells, with 2 bones of red deer (D. Thomas 1993; Bell 2007b, 272–75, 296, figs 20.8–20.10)	5270±80			4330–3950	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
CAR-1421		Worked wood	Site D, context 17, layer over shell midden, including 1 geometric microlith (D. Thomas 1993; Bell 2007b, 272–75, 299, figs 20.8–20.10)	4910±70			3930–3530	
CAR-1420		Charcoal	Site E, context 105, lower layer of shell midden. Midden on margin of wetland deposits, consisting mainly of mussel shells (D. Thomas 1993; Bell 2007b, 275, fig. 20.11)	5530±80			4530–4230	
CAR-1422		Charcoal	Site E, context 104, upper layer of midden, Midden on margin of wetland deposits, consisting mainly of mussel shells (D. Thomas 1993; Bell 2007b, 275, fig. 20.11)	5110±80			4050–3700	
CAR-1355		Charcoal	Site C, bottom layer of midden on margin of wetland deposits, consisting mainly of cockle shells (D. Thomas 1992; Bell 2007b, 271–72, fig. 20.7)	4890±90			3940–3380	
CAR-1356		Charcoal	Site B. Shell midden on margin of wetland deposits, consisting mainly of cockle shells (D. Thomas 1992; Bell 2007b, 270)	4700±70			3650–3350	
Prestatyn, Denbighshire								
OxA-16606	'Prestatyn woman' 4.903	R femur	Found 1924, 400 m W of Nant Hall Road, at interface of boulder clay and overlying peat. Bones of young adult female 'in a heap', skull about 0.60 m from rest (Bell 2007b, 303–305, 309)	4867±38	−19.4		3710–3530	
Wellington Quarry, Marden, Herefordshire, original permitted area								
OxA-12570	3852/1	Charred hazelnut shell	Pit 3852. One of a group of pits containing Neolithic Bowl pottery, struck flint, stone artefacts, animal bone and charred cereals (Bapty 2007; Bayliss *et al*. 2007d; Jackson and Miller forthcoming)	4762±31	−22.8		3640–3380	*3640–3510* (*88%*) or *3425–3380* (*7%*)
OxA-12547	3852/2	Single charred wheat grain	From the same context as OxA-12570	4850±31	−24.5		3700–3530	*3700–3630* (*77%*) or *3580–3530* (*18%*)
OxA-12568	3854/1	Charred hazelnut shell	Pit 3854. One of a group of pits containing Neolithic Bowl pottery, struck flint, stone artefacts, animal bone and charred cereals (Bapty 2007)	4823±32	−23.5		3660–3520	*3660–3620* (*36%*) or *3605–3520* (*59%*)
OxA-12569	3854/2	Single charred wheat grain	From the same context as OxA-12568	4810±33	−23.5		3660–3520	*3655–3620* (*25%*) or *3605–3520* (*70%*)
Wellington Quarry, Marden, Herefordshire, Moreton Camp extension								
Wk-12257	HSM 32268/2406	Single fragment of wood charcoal	Single pit identified during evaluation, containing a reworked fragment of a ground stone axe, a small assemblage of struck flint and a sherd of quartz-tempered pottery (Bapty 2007; Bayliss *et al*. 2007d; Jackson and Miller forthcoming)	5100±79	−25.0±0.2		4050–3700	*4050–3700*

Wellington Quarry, Marden, Herefordshire, new area, 2008								
Beta-245652		Charred hazelnut fragment	Single pit containing plain Neolithic Bowl pottery (Robin Jackson pers. comm.)	4730±40			3640–3370	*3635–3495* (62%) or *3460–3375* (33%)
Cwm Meudwy, Llandysul, Ceredigion								
Beta-185679		*Corylus avellana* charcoal	Pit 50. Small, shallow pit with sherds of at least five Bowls, including two with everted decorated rims (Murphy 2003; Murphy and Evans 2005; Caseldine and Griffiths 2005)	4840±40			3700–3520	*3700–3625* (55%) or *3600–3525* (40%)
Beta-185680		*Corylus avellana* charcoal	Pit 113. Pit with sherds of two Bowls, one shouldered (Murphy 2003; Murphy and Evans 2005; Caseldine and Griffiths 2005)	4870±50			3760–3530	*3710–3625* (76%) or *3590–3525* (19%)
Beta-185678		*Alnus glutinosa* charcoal	Pit 142. Small isolated pit with very charcoal-rich fill but no pottery, to south-west of later prehistoric palisade enclosure, on settlement where most of pottery assessed as early Neolithic (Murphy 2003; Murphy and Evans 2005; Caseldine and Griffiths 2005)	4800±40			3660–3510	*3660–3515* (94%) or *3400–3380* (1%)
Beta-189116		*Prunus* sp. charcoal	Posthole 64. Flanking north-east entrance of sub-trapezoid palisade enclosure, undoubtedly measured on redeposited sample because other entrance postholes of same enclosure yielded dates in second millennium cal BC and first millennium cal AD (Murphy 2003; Murphy and Evans 2005; Caseldine and Griffiths 2005)	5080±40			3970–3770	*3970–3785*
Coygan Camp, Carmarthenshire								
NPL-132		Charred hazelnut shells	Pit CXIX (3). Isolated pit containing sherds of a single heavy-rimmed plain Bowl, struck flint, animal bone, charcoal (Wainwright 1967, 14–20, figs 3, 6)	5000±95	−25.0		3980–3630	*3750–3625* (84%) or *3600–3520* (11%)
Bromfield, Shropshire								
HAR-3968	S163	Bulked charcoal sample	F247. From base of one of two Neolithic pits, overlain by sherds of 3 or 4 Bowls, one heavy-rimmed and one with simple linear decoration on the rim. Also present were charred hazelnut shells, and small amounts of charred cereals and struck flint (Stanford 1982, 282–7)	4680±80	−26.9		3650–3130	*3635–3350*
Plas Gogerddan, Ceredigion								
CAR-994		Unidentified charcoal	Pit 206, containing charred emmer wheat, barley, chaff, apple pips and fragments, hazelnut shells. No artefacts (Murphy 1992, 7, 24–6)	4700±80			3650–3340	*3640–3360*
Carreg Coetan portal dolmen, Pembrokeshire								
CAR-391	Sample 1	Bulked charcoal sample	Old ground surface sealed beneath mound material (Dresser 1985, 381)	4560±80	−28.2		3620–3020	*3625–3600* (2%) or *3525–3290* (93%)
CAR-392	Sample 2	Bulked charcoal sample	F36. Area of burning sealed beneath stone kerb	4830±80	−27.8		3780–3370	*3780–3495* (84%) or *3460–3375* (11%)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
CAR-393	Sample 3	Bulked charcoal sample	Within material of the mound	4470±80	−26.8		3490–2900	*3505–3425* (*14%*) or *3385–3270* (*81%*)
CAR-394	Sample 4	Bulked charcoal sample	F44. Socket of orthostat framing chamber	4700±80	−27.6		3650–3340	*3640–3360*
Sarn-y-bryn-caled cursus, Powys								
OxA-3997	SYBC 92:1	Fast-grown *Quercus* sp. charcoal	Patch of small charcoal fragment immediately above primary silt of east ditch (Gibson 1994)	4960±70	−25.2		3960–3630	*3945–3635*
Fronddyrys, Powys								
HAR-1330		Unidentified charcoal fragments	Cutting 1. In layer below topsoil in small exploratory trench containing much charcoal, flint, a fragment of agate, and pottery including 1 Mortlake Ware sherd (Pye 1975; 1976). Mesolithic and early Neolithic lithics in same field	4530±260			3910–2490	
BM-2953		*Prunus avium* and *Frangula alnus* charcoal	From the same context as HAR-1330 (Gibson 1995; Gibson and Kinnes 1997; Ambers and Bowman 1998) Both dates deemed rejected and/or unusable by Gibson and Kinnes on ground of admixture of earlier material, and both excluded here for the same reason	5480±45	−24.0		4450–4250	
Penywyrlod, Talgarth, long cairn, Powys								
HAR-674		Human. Bulked sample of broken small bone	Bone from chamber NEII (Britnell and Savory 1984, 19–20)	4970±80	−21.5		3960–3630	*3950–3640*
Gwernvale long cairn, Powys								
CAR-118		Unidentified bulk charcoal sample	Pit F308. Lower fill of pit partly sealed by A horizon of pre-cairn soil. No contained artefacts (Britnell and Savory 1984, 50)	6900±80	−26.4		5990–5630	
CAR-113		Unidentified bulk charcoal sample	Pit F68. Dark ashy soil forming upper layer of pre-cairn pit containing struck flint and some sherds of Carinated Bowl pottery and Mesolithic and early Neolithic lithics (Britnell and Savory 1984, 55, 101)	5050±75	−26.0		3990–3650	*3980–3690* (*94%*) or *3685–3660* (*1%*)
CAR-114		Unidentified bulk charcoal sample	Pit F58. Pit outside cairn and sealed by blocking, containing sherds of a Peterborough Ware bowl (Britnell and Savory 1984, 88–9, 104)	4390±70	−26.2		3340–2880	
CAR-116		Unidentified bulk charcoal sample	Pit F47. Pit outside cairn outside cairn and sealed by blocking, adjacent to F58 and containing a sherd of the same Peterborough Ware vessel as was found in F58 and in surrounding area (Britnell and Savory 1984, 88–9, 103–4)	4590±75	−25.8		3630–3090	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Lower Luggy long barrow, Powys								
BM-2954		Fast-grown *Quercus* sp. charcoal	Trench 1. Outer rings of partly charred post *c.* 0.10 m in diameter, closely set in palisade trench along SE side of barrow and extracted from NE section of trench mid-way along its length (Gibson 2000, 6–11; 2003)	4830±45	−24.1		3640–3360	*3705–3520*
BM-2955		Fast-grown *Quercus* sp. charcoal	Trench 2. Outer rings of post *c.* 0.20 m in diameter, burnt *in situ* near proximal end of palisade trench along SE side of barrow (Gibson 2000, 10–11; 2003)	4710±40	−23.8		3640–3360	*3635–3555* (*28%*) or *3540–3485* (*21%*) or *3475–3370* (*46%*)
Pipton long cairn, Powys								
OxA-14396	P14/99.5 H/12	Human. Adult L ulna	Entrance passage to chamber I	4653±34	−18.7		3620–3350	*3520–3360*
OxA-12083	P15/99.5 H/11	Human. Adult R mandible	Inner passage, chamber I (Savory 1956)	4601±33	−20.3		3500–3190	*3500–3430* (*50%*) or *3380–3335* (*45%*)
OxA-14254	P21/99.5 H/19	Human. Skull fragment	Under floor slab, in S annex of chamber I	4742±34	−20.5		3640–3370	*3640–3495* (*74%*) or *3435–3375* (*21%*)
OxA-14251	P19/99.5 H/4[2]	Human. R femur	Group C, chamber II	4866±32	−20.4		3710–3540	*3705–3630* (*91%*) or *3555–3535* (*4%*)
OxA-14252	P18/99.5 H/2	Human. R femur	Group D, chamber II	4906±33	−20.6		3770–3630	*3710–3640*
OxA-14253	P20/99.5 H/21	Cattle. Horncore	Forecourt	4658±33	−21.3		3630–3360	*3520–3360*
Parc le Breos Cwm long cairn, Swansea								
OxA-6487	PC#1	Human. Adult L humerus	SE chamber (Whittle and Wysocki 1998)	4685±65	−21.2		3640–3340	*3635–3550* (*22%*) or *3540–3360* (*73%*)
OxA-6496	PC#11	Human. L humerus	SE chamber (Whittle and Wysocki 1998)	4850±65	−21.5		3770–3510	*3715–3510* (*92%*) or *3425–3380* (*3%*)
OxA-6641	PC#2	Human. Adult. L humerus	SE chamber (Whittle and Wysocki 1998)	4690±55	−20.4		3640–3350	*3635–3555* (*21%*) or *3540–3360* (*74%*)
OxA-6488	PC#3	Human. Adult L humerus	SW chamber (Whittle and Wysocki 1998)	4780±60	−20.7		3660–3370	*3660–3495* (*77%*) or *3460–3375* (*18%*)
OxA-6489	PC#4	Human. Adult L humerus	SW chamber (Whittle and Wysocki 1998)	4445±60	−21.3		3360–2910	
OxA-6493	PC#8	Human. Adult. L humerus	NE chamber (Whittle and Wysocki 1998)	4875±55	−21.8		3780–3530	*3715–3620* (*74%*) or *3600–3520* (*21%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
OxA-6494	PC#9	Human. Adult L humerus	NE chamber (Whittle and Wysocki 1998)	4645±60	−21.4		3630–3130	*3630–3580* (*9%*) or *3535–3335* (*86%*)
OxA-6490	PC#5	Human. Adult L humerus	NW chamber (Whittle and Wysocki 1998)	4660±60	−21.2		3640–3340	*3635–3575* (*12%*) or *3535–3345* (*83%*)
OxA-6491	PC#6	Human. Adult L humerus	NW chamber (Whittle and Wysocki 1998)	4710±60	−21.2		3640–3360	*3635–3365*
OxA-6495	PC#10	Human. Subadult skull	Passage (Whittle and Wysocki 1998)	3705±55	−21.4		2290–1940	
OxA-6492	PC#7	Human. L humerus	Passage (Whittle and Wysocki 1998)	4805±55	−21.3		3700–3380	*3695–3500* (*87%*) or *3430–3380* (*8%*)
OxA-6497	PC#12	Human. Occipital	Passage (Whittle and Wysocki 1998)	3750±55	−21.6		2340–1980	
Ty Isaf long cairn, Powys								
OxA-12055	9/39.190/315	Human. Adult cranium, ?female	C compartment of rotunda, lower level (Grimes 1939, 128–9, 142)	4529±31	−20.4		3370–3090	*3370–3295*
OxA-14248	TI 1/39.190/316.1	Human. Cranium (Individual a)	C compartment of rotunda, lower level (Grimes 1939, 128–9, 142)	4202±31	−20.5		2900–2670	
OxA-14393	TI 2/39.190/316.2	Human. Cranium (Individual b)	C compartment of rotunda, lower level (Grimes 1939, 128–9, 142)	4523±35	−18.9		3370–3090	*3370–3290*
OxA-14250	TI 9/39.190/200	Human. Cranium	C compartment of rotunda, upper level (Grimes 1939, 128–9, 142)	4082±30	−20.8		2860–2490	
OxA-14394	TI 5/39.190/54	Human. Adult R humerus	Passage of rotunda (17.9) (Grimes 1939, 128–9, 142)	4658±32	−18.9		3620–3360	*3520–3360*
OxA-14249	TI 7/39.190/56	Human. Adult R humerus. Replicate of OxA-14395	Passage of rotunda (17.9) (Grimes 1939, 128–9, 142)	4545±50	−20.6	4550±29	3370–3100	*3485–3475* (*1%*) or *3370–3310* (*94%*)
OxA-14395	TI 7 repeat	Replicate of OxA-14249	From the same context as OxA-14249 (Grimes 1939, 128–9, 142)	4552±35	−19.5	T'=0.0; T'(5%)= 3.8; ν=1		
Llandygai house B1, Gwynedd								
NPL-223		Bulk sample of mature *Quercus* sp. charcoal	Posthole 9. Within stone packing, probably parts of post (Lynch and Musson 2001, 27–36, 116–18)	5240±150	−25.7±1.0		4360–3700	
GrN-26824	Sample B98	45 g of *Quercus* sp. charcoal	Posthole 12. Among stone packing. Sample included large fragments from core of post post (Lynch and Musson 2001, 27–36, 116–18)	5055±25	−26.6		3960–3770	
GrN-26823	Sample B77	60 g of charcoal, 38 fragments *Quercus* sp., 3 too incinerated for identification	Posthole 2. Among stone packing, probably from post pipe (Lynch and Musson 2001, 27–36, 116–18)	5040±30	−24.3		3960–3710	
GrA-20012	Sample B72	Single charred hazelnut shell fragment	Posthole 5. Among stone packing for post (Lynch and Musson 2001, 27–36, 116–18)	4860±50	−25.7		3720–3520	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
Lower Luggy enclosure, Powys								
Beta-177037		*Corylus* sp. twigs, charcoal	Charcoal deposit on ditch terminal floor (100SW) immediately below primary silts (Gibson 2006)	4760±50			3650–3370	*3640–3495* (*71%*) or *3455–3375* (*24%*)
Beta-206282		*Corylus* sp. twigs, charcoal	From the same context as Beta-177037	4690±40			3640–3360	*3630–3580* (*11%*) or *3535–3365* (*84%*)
Beta-206283		*Corylus* sp. charcoal	Middle silts of ditch, redeposited (Gibson 2006)	4980±40			3940–3650	*3940–3870* (*14%*) or *3810–3655* (*81%*)
Church Lawford , Warwickshire								
SUERC-3385		Single fragment of *Alnus/Corylus* charcoal	304/8/1. Charcoal-rich fill of shallow scoop cut into the third and most substantial fill of enclosure ditch, overlain by a layer rich in Peterborough and Grooved Ware. Interpreted by excavator as *terminus post quem* for context (S. Palmer 2003; forthcoming)	4520±45	−24.8		3370–3020	*3370–3105*
Wk-14819 (conventional)	TR99:C:304/8/2	Bulk sample of *Alnus/Corylus* charcoal	304/8/2. From the same context as SUERC-3385	4834±88	−25.0±0.2		3790–3370	*3710–3485* (*75%*) or *3475–3370* (*20%*)
Brynderwen, Powys								
OxA-4409		Carbonised residue from sherd	Single sherd of Fengate Ware retrieved by cleaning section of pit exposed in pipe trench within undated sub-rectangular enclosure *c.* 100 m across (Gibson and Musson 1990; Gibson and Kinnes 1997)	4440±70	−28.8		3370–2900	*3330–2915*
OxA-5317		Charred hazelnut shell fragment	From the same context as OxA-4409	4550±50	−23.4		3500–3090	*3375–3085*
A477 Sageston-Redberth bypass, Pembrokeshire								
Wk-10153	SR01-026	'small charcoal sample', of *Corylus avellana*	Context 026. Secondary fill of linear pit 025 on west end of 'settlement of early to late Neolithic date' covering 100 m of easement and extending to either side of it (Page 2001; 2002; Gale 2002)	4656±67	−26.9±0.2		3640–3130	*3635–3555* (*14%*) or *3540–3345* (*81%*)
Wk-10156	SR01-517	'small charcoal sample', of *Corylus avellana*	Context 517. Spread of burnt material on east end of 'settlement of early to late Neolithic date' covering 100 m of easement and extending to either side of it (Page 2001; 2002; Gale 2002)	4553±62	−25.0±0.2		3500–3020	*3520–3420* (*32%*) or *3385–3295* (*63%*)
Wk-10158	SR01-537	'small charcoal sample', of *Corylus avellana*	Context 537. Fill of posthole 536 in posthole row 552 on west end of 'settlement of early to late Neolithic date' covering 100 m of easement and extending to either side of it (Page 2001; 2002; R. Gale 2002)	4965±57	−27.3±0.2		3950–3640	*3740–3635*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
Wk-10159	SR01-554	'small charcoal sample', of *Corylus avellana*	Context 554. Fill of posthole 553, one of a pair west of row 552, on west end of 'settlement of early to late Neolithic date' covering 100 m of easement and extending to either side of it (Page 2001; 2002; Gale 2002)	4791±57	−24.9±0.2		3700–3370	*3695–3680* (*1%*) or *3665–3495* (*82%*) or *3440–3375* (*12%*)
Ogmore-by-Sea, Bridgend								
HAR-1140		Charred hazel nutshells	Occupation layer in sand dunes. Webley (1976, 35), Savory (1980, 228) and Gibson (1998, fig. 1) attribute it to the upper of two layers associated with Mortlake Ware. Hamilton and Aldhouse-Green state that this sample came from the lower of two layers (1998, 113), as does Peterson (2003, 115)	4320±80			3640–3090	*3320–3215* (*6%*) or *3185–3155* (*1%*) or *3130–2855* (*88%*)
BM-1112		Unidentified bulk charcoal sample	Occupation layer in sand dunes. Webley (1976, 35), Savory (1980, 228) and Gibson (1998, fig 1) attribute it to the lower of two layers associated with Mortlake Ware. Hamilton and Aldhouse-Green state that this sample came from the upper (1998, 113), as does Peterson (2003, 115)	4659±52	−25.4		3630–3340	*3635–3575* (*10%*) or *3535–3345* (*85%*)
OxA-5318		Carbonised residue	From Mortlake Ware. Sample very small and carbon content very low (Gibson 1995b, 38). Excluded from model	5870±90	−29.3		4950–4610	
Sarn-y-bryn-caled II, Powys								
BM-2820		*Quercus* sp. charcoal	Recut in penannular ring ditch, containing cremations and some small Mortlake Ware sherds (Gibson 1994, 159–61, 171–3)	4400±45	−23.7		3330–2900	*3325–3230* (*11%*) or *3175–3155* (*1%*) or *3120–2905* (*83%*)
BM-2819		*Quercus* sp. charcoal	From the same context as BM-2819	4220±40	−23.8		2910– 2670	*2920–2835* (*86%*) or *2815–2755* (*9%*)
Upper Ninepence, Powys								
BM-2967	17	Bulk sample of 'mixed short-lived wood charcoal' (Ambers and Bowman 1998, 427)	Pit 16. Containing Mortlake Ware sherds, struck flint, charred hazelnut shells, *Corylus,* Pomoideae and *Prunus* charcoal (Gibson 1999, 33–8, 84–7, 143, 150–3)	4400±50	−24.8		3330–2900	*3320–3225* (*10%*) or *3180–3155* (*2%*) or *3125–2900* (*83%*)
BM-2966	21	Bulk sample of *Corylus avellana* and *Populus* sp. charcoal	Pit 20. Containing Peterborough Ware sherds, struck flint (Gibson 1999, 33–8, 84–7)	4410±35	−24.6		3320–2910	*3310–3290* (*1%*) or *3265–3235* (*4%*) or *3120–2910* (*90%*)
SWAN-23	U9D I: Context 66	Bulk sample of *Corylus avellana* charcoal	Pit 65. Containing a Mortlake Ware sherd and struck flint (Gibson 1999, 33–8, 84–7)	4470±80	−26.1		3490–2900	*3340–2920*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
BM-3071		Bulk sample of *Corylus avellana* charcoal	Pit 200. Containing Fengate Ware sherds, charred hazelnut shells, a few charred wheat grains, *Quercus* (only one fragment), *Corylus*, Pomoideae and *Prunus* charcoal (Gibson 1999, 33–8, 84–7, 143, 150–3)	4590±60	−24.2		3520– 3090	*3495–3430*.(4%) or *3385–3085* (*91%*)
BM-3070		Bulk sample of *Corylus avellana* charcoal	Pit 500. Containing Fengate Ware sherds, charred hazelnut shells, *Corylus*, Pomoideae and *Prunus* charcoal (Gibson 1999, 33–8, 84–7, 143, 150–3)	4490±60	−24.7		3370– 2920	*3355–3005* (*93%*) or *2980–2955* (*2%*)
Cefn Bryn, Great Carn, Gower, Swansea								
Birm-1235		Charcoal	Pit containing Mortlake Ware and struck flint, sealed beneath pre-cairn ground surface (Ward 1987; Gibson 1995)	4230±95			3090–2500	
Birm-1236		Charcoal	Hearth associated with Mortlake Ware and struck flint, sealed beneath pre-cairn ground surface (Ward 1987; Gibson 1995b)	3960±100			2870–2140	
Birm-1237		Charcoal	Posthole associated with Mortlake Ware and struck flint, sealed beneath pre-cairn ground surface (Ward 1987; Gibson 1995b)	4340±100			3350–2670	
Birm-1238		Charred hazelnut shell	From the same context as Birm-1237 (Ward 1987; Gibson 1995b)	3990±100			2880–2200	
Four Crosses, Powys, site 5								
CAR-670		Charcoal (other charcoal from same context identified as *Quercus*)	Charcoal concentration in one part of base of burial pit, overlying one of two slots bracketing inhumation accompanied by pear-shaped stone, animal jaw and undecorated bag-shaped, round-based bowl with flaring neck of profile and fabric compatible with Ebbsfleet Ware (Warrilow *et al*. 1986, 64–5, 71; Gibson 1995b)	4440±70			3370–2900	*3340–2920*
Meole Brace, Shropshire								
OxA-4206	3-F10 (1013)	*Quercus* stem, *Corylus* stem and Pomoideae charcoal (small fragments recovered by dry sieving)	Pit F10, context 1024. Pit containing Mortlake Ware sherds. One of a group outside ring ditch (Hughes and Woodward 1995)	4570±85	−24.3		3630–3020	*3390–3005* (*92%*) or *2990–2930* (*3%*)
Trostrey Castle, Monmouthshire								
Beta-169094	C476	Charcoal	Base of post 0.40 m in diameter, rotted *in situ*. One of 3 large postholes S of ovoid stone mound (Mein 2002)	5050±50			3970–3700	*3960–3755* (*89%*) or *3745–3710* (*6%*)
Beta-173357	C532	Charcoal. Undated remainder mainly scrubby and short-lived, identified by Rowena Gale	Pyre 3 (Mein 2002, 107–8; Mein 2003, 67)	4800±90			3770–3360	*3760–3735* (*1%*) or *3715–3365* (*94%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
GU-4414	C278	Charcoal	Pyre 1. Later series of firings in linear hearth seen as pyre and including pottery described as Grimston Ware (Mein 1996, 65; 2003, 67)	4930±70	−25.4		3940–3530	*3945–3850* (*12%*) or *3825–3630* (*81%*) or *3560–3535* (*2%*)
GU-2559	C91	Charcoal	Hearth in flint-working area including leaf arrowheads (Mein 1994, 50; 1996, 65)	4820±80	−23.4		3770–3370	*3770–3490* (*82%*) or *3465–3370* (*13%*)
GU-2634		Charcoal	From a firepit (Mein 1992, 11)	5340±60	−27.5		4340–3990	*4330–4040*
Nanna's Cave, Caldey Island, Pembrokeshire								
OxA-7740	63.335/61.1	Human. Patella	From a cave containing scatters of fragmentary human bone, as well as Upper Palaeolithic, Mesolithic and Neolithic artefacts, including a rim fragment from a plain Bowl (Lacaille and Grimes 1955, 96–120; 1961, 36–7; van Nedervelde 1977)	4520±45	−21.2		3370–3020	*3495–3465* (*6%*) or *3375–3185* (*89%*)
OxA-7739	91.9H/4	Human. Femur	From the same cave as OxA-7740	4560±45	−21.1		3500–3090	*3500–3425* (*21%*) or *3380–3260* (*69%*) or *3245–3180* (*5%*)
Ogof-yr-Benlog, Caldey Island, Pembrokeshire								
OxA-7743	88.71H/2	Human. Female vertebra	From a cave (Schulting and Richards 2002a)	4660±45	−19.8		3630–3350	*3630–3590* (*6%*) or *3530–3355* (*89%*)
Foxhole Cave, Gower								
OxA-8318	FX177	Human. Adult phalange	Layer 3. Soliflucted scree, yielding early Mesolithic artefacts and late glacial fauna, much disturbed by badger set. Stratified below layer 2 (Aldhouse-Green 2000, 14–18; Pettitt 2000)	4840±45	−20.3		3710–3520	*3710–3620* (*54%*) or *3605–3520* (*41%*)
OxA-8315	FX32	Human. Adult phalange	Layer 2. Humic scree, yielding modern and early Mesolithic artefacts, much disturbed by badger set. Stratified above layer 3 (Aldhouse-Green 2000, 14–18; Pettitt 2000)	4940±45	−20.3		3900–3640	*3775–3640*
OxA-8317	FX59	Human. Adult tooth	Layer 1. Modern topsoil, overlying layer 2 (Aldhouse-Green 2000, 14–18; Pettitt 2000)	4625±40	−20.6		3520–3340	*3520–3345*
Little Hoyle Cave, Pembrokeshire								
OxA-3304	1983.2376/2	Human. Adult mandible	From a group of human remains representing c. 17 individuals found in 19th century excavations in the infill of a shaft or 'chimney' connecting Little Hoyle Cave system to surface of ridge above, where two stakeholes, Neolithic Bowl pottery and a lithic scatter have been found (Green *et al*. 1986; R. Hedges *et al*. 1993, 151)	4930±80	−21.2		3950–3530	*3800–3625* (*85%*) or *3600–3525* (*10%*)
OxA-3306	1983.2435/9	Human. Adult mandible	From the same group as OxA-3304	4880±90	−20.4		3940–3380	*3785–3500* (*91%*) or *3430–3380* (*4%*)
OxA-3305	1983.2376/11	Human. Adult mandible	From the same group as OxA-3304	4750±75	−19.9		3660–3360	*3655–3365*
OxA-3303	1983.2375/5	Human. Adult mandible	From the same group as OxA-3304	4660±80	−19.4		3640–3120	*3635–3335*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Priory Farm Cave, Monkton, Pembrokeshire								
OxA-10647	09.18/101.4	Human. Adult mandible	From among the disarticulated, fragmented remains from several individuals, recovered from a cave that had seen intermittent activity from the upper Palaeolithic to the historical period (Grimes 1933). Measurement probably anomalously old (Bronk Ramsey *et al.* 2004a; Bayliss et al. 2007a, fig. 25)	4950±45	−20.6			
Red Fescue Hole, Rhosili, Swansea								
OxA-10649	2001.5H/4	Human. Adult fibula	Found in limited excavation in entrance of coastal cave with fragmentary human femur, animal bones, limpet and mussel shells (M. Davies 1986a; Schulting and Richards 2002a). Measurement probably anomalously old (Bronk Ramsey *et al.* 2004a; Bayliss *et al.* 2007a, fig. 25)	4880±40	−19.9			
Spurge Hole, Southgate, Swansea								
OxA-3815		Human. Adult femur, probably male	Articulated burial found in limited excavation, lying across cave entrance, demarcated by boulders on outer side (M. Davies 1986b; Aldhouse-Green *et al.* 1996; Schulting and Richards 2002a)	4830±100	−19.8		3900–3360	*3760–3490 (79%) or 3470–3370 (16%)*

may suggest fifth millennium cal BC activity (Table 11.4), and one context overlying the midden there has a radiocarbon date (Table 11.4: CAR-1421) suggesting fourth millennium activity as well (Bell 2007b). A similar pattern is suggested by dates on charcoal samples from sites E, C and B (Table 11.4; Bell 2007b), and not far away, an unassociated adult female has been dated to the earlier fourth millennium cal BC (Table 11.4: OxA-16606; Bell 2007b).

An early Neolithic presence can be widely documented throughout the area covered by this chapter, though recovery of evidence, as for the Mesolithic, has had an uneven history. In the Marches, early Neolithic settlement has been identified in river valleys and on the terraces above them, as have cursus monuments (Ray 2007; Gibson 1999; 2002b). This has been given fresh focus by the new project 'Beneath Hay Bluff', led by Keith Ray and Julian Thomas, including investigation of a megalith in the Olchon valley. On the east side of the Black Mountains, flint collectors have provided abundant evidence for early Neolithic activity in the Golden Valley, which runs south from Dorstone Hill (Olding 2000, fig. 5), and farther west, pollen analysis of the upper levels of the lake sequence at Waun Fignen Felen may suggest early Neolithic clearance (Smith and Cloutman 1988; Barton *et al.* 1995, 84). On the south-west of the Black Mountains an inland presence is documented in greater detail in the occupation under the Gwernvale long cairn, in the upper Usk valley (Britnell 1984).

The settlement evidence from lowland and coastal south-east Wales is scattered and of variable quality. At Goldcliff, early Neolithic clearance may be suggested by pollen analysis (A. Caseldine 2000, 219–20; Bell 2007b), although there are very few early Neolithic artefacts (Bell 2007b). Lithics from all stages of the Neolithic are plentiful, for example, near the coast at the west end of the Ogmore valley at Ogmore-by-Sea and close by at Merthyr-Mawr Warren, both long established collecting grounds (Burrow 2006b, fig. 16; Webley 1976; Hamilton and Aldhouse-Green 1998). Farther west, the evidence remains diffuse. A pit at Coygan Camp, Carmarthenshire (Wainwright 1967), has recently been augmented by others near Redberth (Page 2001; 2002) and, farther north, at Llandysul, Ceredigion (Murphy 2003; Murphy and Evans 2005). On the Pembrokeshire coast, an early Neolithic presence is attested by lithic scatters, most of them multi-period (C. Barker 1992; Tilley 1994). Excavation within one of these, at Stackpole Warren, recovered fragments of three Bowls, one with a pronounced, decorated rim (Benson *et al*. 1990; Darvill 1990). Overall, we are probably at the stage of research where quite widespread activity of probable fourth millennium cal BC date can be identified over this broad area, but where clear patterns have not yet been established.

Monuments other than enclosures are represented, broadly speaking, by the long cairns of the Black Mountains, the south-east Welsh coastal lowland and the Gower peninsula (Corcoran 1969; Cummings and Whittle 2004; F. Lynch 2000), and the portal dolmens and related constructions of south-west Wales (F. Lynch 1972; C. Barker 1992;

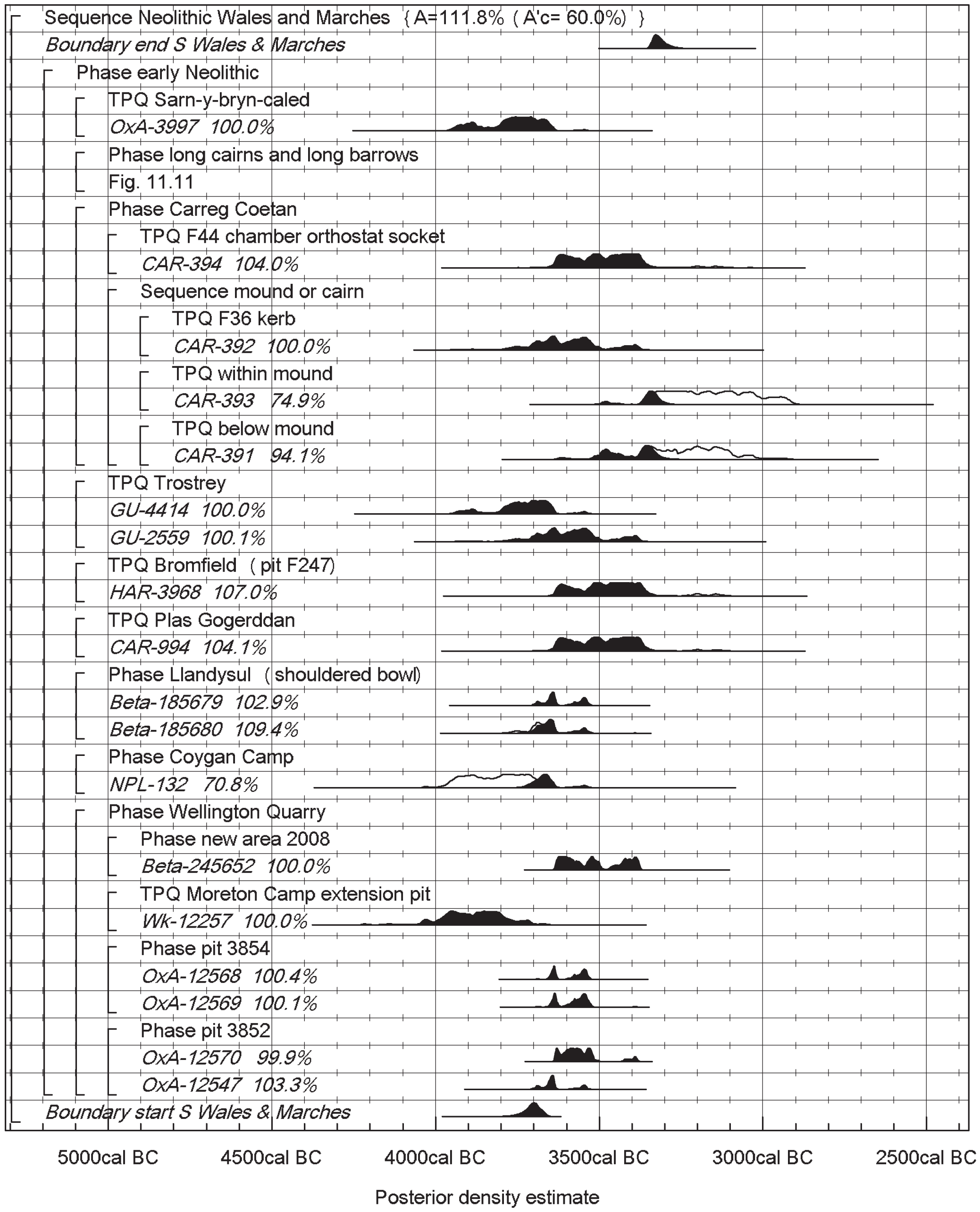

Fig. 11.10. South Wales and the Marches. Overall structure of the chronological model for the date of the early Neolithic. The component section of this model relating to long cairns is shown in detail in Fig. 11.11. The large square brackets down the left-hand side of Figs 11.10–11, along with the OxCal keywords, define the overall model exactly.

Cummings and Whittle 2004; Cummings 2009). Cursus monuments have been confidently identified in Powys, in the Walton basin (Gibson 1999) and in the upper Severn valley at Sarn-y-bryn-caled (Gibson 1994), but not so far in south or west Wales. Farther east such monuments are more abundant in the catchment of the Warwickshire Avon (Loveday 1989; Hughes and Crawford 1995; Hingley 1996; W. Ford 2003). There is a long enclosure attached to a sub-trapezoid enclosure at Church Lawford, Warwickshire, and the layout as a whole (though not the smaller size) recalls that of Godmanchester in the Great Ouse valley of eastern England (McAvoy 2000; and see Chapter 6).

A model which estimates the chronology of the early Neolithic in the Marches and south Wales is shown in Figs 11.10–11. Figure 11.10 shows the overall form of the model, with the component section relating to long cairns given in Fig. 11.11. This model includes radiocarbon determinations from samples directly associated with diagnostic material culture.

Turning first to occupation sites, in the Lugg valley, some 4 km downstream from the Hill Croft Field enclosure, excavation in advance of gravel extraction at Wellington Quarry, Marden, Herefordshire, has revealed a group of 13 pits, containing decorated and plain Neolithic Bowl pottery, lithics, animal bone, charred cereals and hazelnut shells (Bapty 2007; Jackson and Miller forthcoming). Single-entity

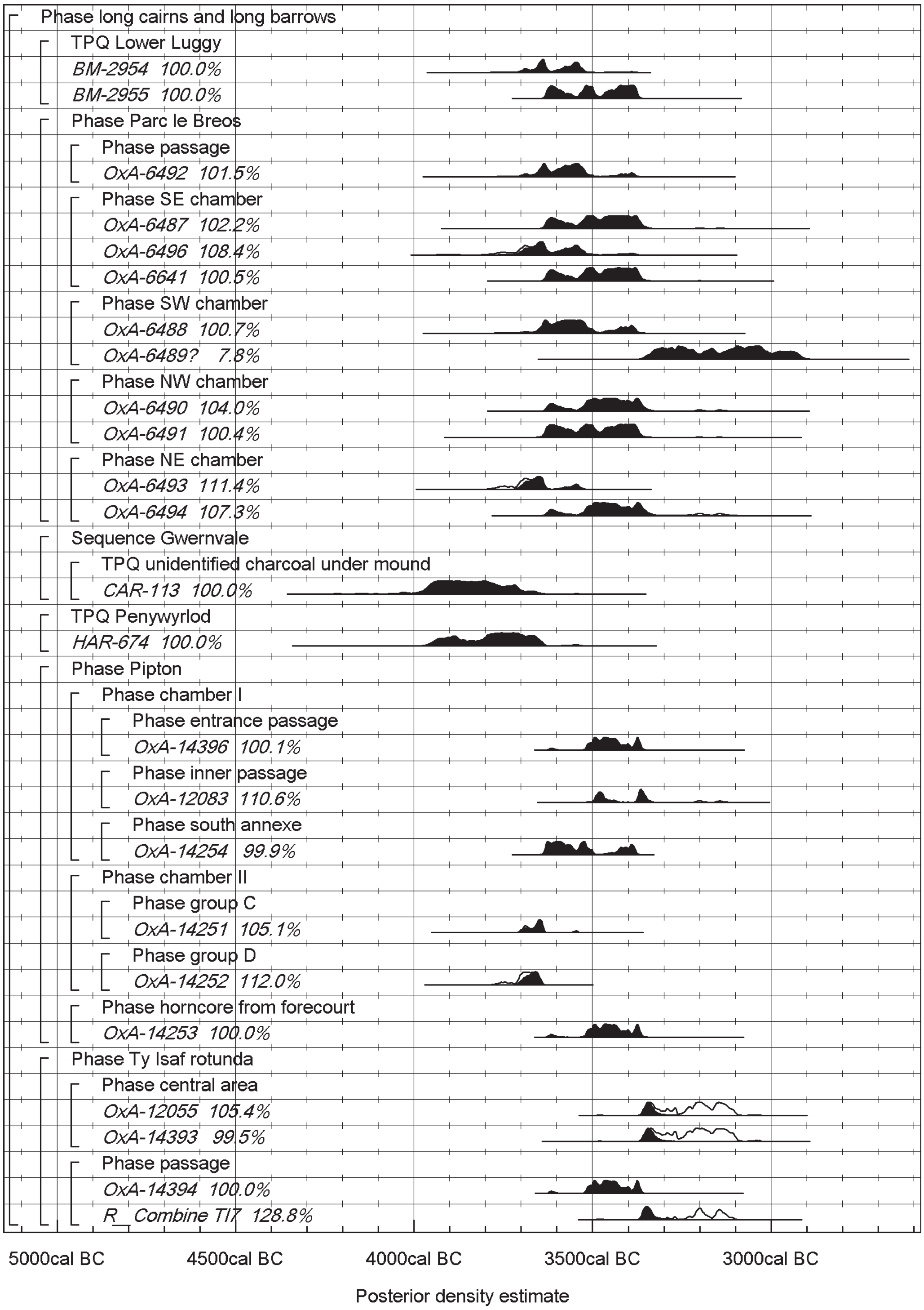

Fig. 11.11. Welsh long cairns. Probability distributions of dates. The format is identical to that of Fig. 11.3. The overall structure of this model is shown in Fig. 11.10.

short-life samples have been dated from two pits (3852, 3854) which were probably open at the same time on the evidence of conjoining sherds (Fig. 11.10: *OxA-12547, -12568–70*). The four measurements are statistically consistent (T'=1.2; T'(5%)=3.8; ν=3). An apparently isolated pit in another part of the quarry contained a reworked fragment of a ground stone axehead, a small assemblage of struck flint, and a sherd of quartz-tempered pottery, and unidentified charcoal (Bapty 2007). One charcoal fragment has been dated (Fig. 11.10: Wk-12257). A charred hazelnut fragment has been dated from a further pit, containing plain Neolithic pottery, in a newly evaluated part of the site (Fig. 11.10: Beta-245652; Robin Jackson, pers. comm.). This activity is broadly contemporary with the nearby enclosure at Hill Croft Field.

One of the best preserved and fully investigated occupation

sites is at Gwernvale in the upper Usk valley on the south-west side of the Black Mountains, where the terrace on which a long cairn was eventually built was occupied intermittently from the upper Palaeolithic onwards (Britnell 1984). This is thus among the many sites where late Mesolithic and early Neolithic remains occur at the same location, and its history invites comparison with those of Hazleton and Ascott-under-Wychwood in the Cotswolds (Chapter 9). The late Mesolithic industry is characterised by scalene triangle and rod microliths. It is impossible to tell if it was associated with a pit some 25 m away from the main concentration of Mesolithic material which contained no artefacts but yielded charcoal dated to 5990–5630 cal BC (95% confidence; Table 11.4: CAR-118; Britnell 1984, figs 13, 58). There may have been an interval between the last two pre-cairn occupations. The early Neolithic assemblage had a virtually identical distribution to its predecessor (Britnell 1984, figs 43, 58) and was focussed on one or two rectangular timber structures, represented by bedding trenches and stone-packed postholes (Britnell 1984, 50–4, 139–41, figs 14, 23). If there was a single building, it would have measured 5.50 m by at least 10 m, on the scale of the better preserved rectangular structures of the early fourth millennium elsewhere in Britain and Ireland (F. Lynch 2000, 52, fig. 2.2). The pottery assemblage, all of potentially local clays (Darvill 1984c), was completely undecorated and included both open, light-rimmed Carinated Bowls and heavier-rimmed, unshouldered vessels (Britnell 1984, 97–105; F. Lynch 1984). There were also a few pits, and an unidentified bulk charcoal sample was dated from one of them, which contained struck flint and sherds of a Carinated Bowl (Table 11.4; Britnell and Savory 1984, 101). This date (*CAR-113*; Fig. 11.11) provides a *terminus post quem* for the contents of the pit and, by implication, the rest of the occupation and the raising of the cairn.

A pit within Coygan Camp, an Iron Age and later promontory fort overlooking Carmarthen Bay, contained a large block of sandstone, 24 sherds from a single heavy-rimmed plain Bowl, struck flint and small animal bone fragments (among which the long bone shafts were cattle- and caprine-sized), charcoal and charred hazelnut shells. A sample of hazelnut shells was dated in the mid-1960s (Fig. 11.10; Table 11.4: *NPL-132*; Wainwright 1967, 14–20, 128–9, 191). Although this was a bulk sample, it is treated as close in age to its context, since it consisted entirely of short-lived material, the components of which were probably not redeposited because the pit itself was an isolated one and because Mesolithic and Neolithic remains on the promontory were spatially distinct (Wainwright 1967, 12–14, 175–7). Two samples of short-life charcoal have been dated from pits containing Bowl pottery, some of it decorated and shouldered, at Llandysul, Ceredigion (Fig. 11.10; Table 11.4: *Beta-185679–80*; Murphy and Evans 2005). At Plas Gogerddan, Ceredigion, a pit containing charred emmer wheat, barley, chaff, apple pips and fragments and hazelnut shells, but no artefacts, yielded a bulk charcoal sample which provides a *terminus post quem* of the mid-fourth millennium cal BC for the cereals (Fig. 11.10: *CAR-994*; Murphy 1992, 7, 24–6). At Bromfield, Shropshire, a sample of unidentified bulk charcoal was dated from a pit containing sherds of three or four Bowls and small amounts of charred cereals (Fig. 11.10; Table 11.4: *HAR-3968*; Stanford 1982, 282–7), although this measurement only provides a *terminus post quem* for the context.

Excavations at Trostrey Castle, Monmouthshire, have been summarised so far only in interim reports by the late Geoffrey Mein. They produced among other features (further described below) a post-built façade at one end of which cremation deposits were buried in five pits. All included pottery described as Grimston Ware, each initially marked by a post, and, when they had gone out of use, by a stone cairn (Mein 2003, 67–8). Beyond the façade, two rows of posts led to cremation pyres, charcoal from two of which is dated (Table 11.4: Beta-173357, GU-4414). *GU-4414* (Fig. 11.10) a bulk sample of unidentified charcoal, provides a *terminus post quem* for Pyre 1, which included a leaf-shaped arrowhead and a sherd described as Grimston Ware. Charcoal from two further features has also yielded fourth millennium dates (Table 11.4: GU-2559, -2624), as has a posthole seen as forming the corner of a hurdle-walled rectangular house (Beta-155430), although the actual result is not cited (Mein 2003, 110). *GU-2559* (Fig. 11.10), another bulk sample of unidentified charcoal, provides a *terminus post quem* for a hearth in a flint-working area which included leaf arrowheads (Mein 1994, 50; 1996, 65).

Among the monuments, a series of unidentified bulk charcoal samples were dated from the Carreg Coetan portal dolmen, Pembrokeshire (Rees 1992, 15–16; C. Barker 1992, 19–21; Cummings and Whittle 2004, 141). Each of these measurements therefore provides a *terminus post quem* for the context from which it was recovered. Our understanding of stratigraphy is based on interim information provided in advance of full publication (Dresser 1985; Rees 1992, 15–16; C. Barker 1992, 19–21; Cummings and Whittle 2004, 141). Three samples (CAR-391–3) come from the small, low, surrounding mound or cairn and its 'kerb', but these features need not be directly associated with the chamber. From the chamber there is one sample, CAR-394, from the socket of one of the orthostatic uprights (Table 11.4).[2] This sample provides a *terminus post quem* for the erection of this orthostat, whereas the building of the mound or cairn may be best dated by the *terminus post quem* provided by CAR-393. The model shown in Fig. 11.10 suggests that the dolmen was erected after *3640–3360 cal BC* (*95% probability*; Fig. 11.10: *CAR-394*), probably after *3630–3585 cal BC* (*15% probability*) or *3530–3490 cal BC* (*15% probability*) or *3470–3370 cal BC* (*38% probability*). The surrounding mound or cairn may have been built somewhat later, after *3505–3425 cal BC* (*14% probability*; Fig. 11.10: *CAR-393*) or *3385–3270 cal BC* (*81% probability*), probably after *3370–3310 cal BC* (*68% probability*). Although other monuments of this general kind contain typologically early pottery (F. Lynch 1976), we may have to question long-held assumptions, based on their architectural simplicity, that portal dolmens have all to be early in the Neolithic sequence.

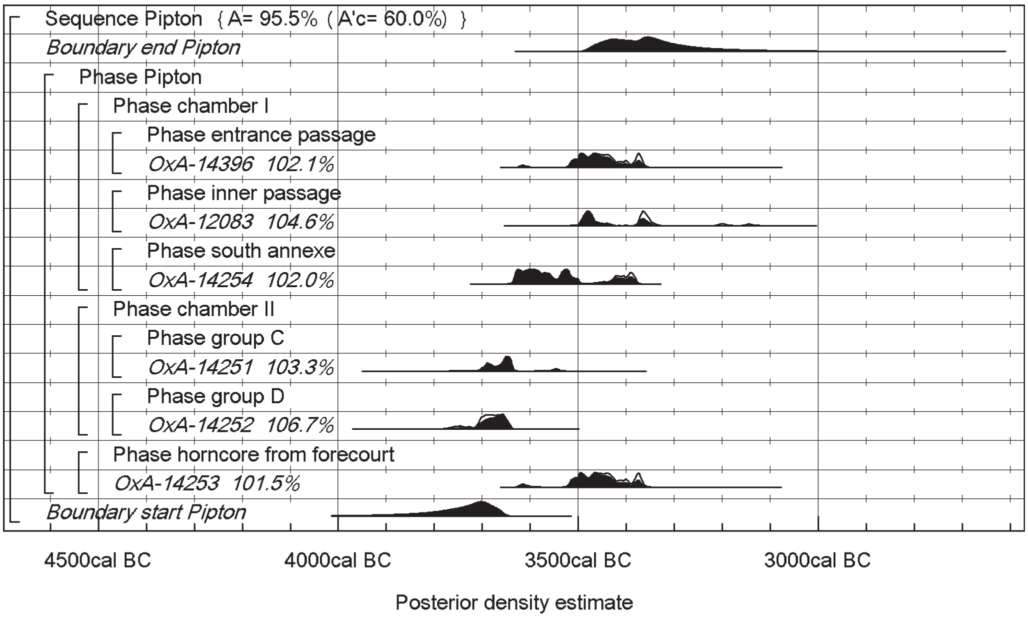

Fig. 11.12. Pipton. Probability distributions of dates. The format is identical to that of Fig. 11.3. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Among the Welsh long cairns and barrows, a bulk sample of broken small bones, probably from a variety of individuals, was dated from the NEII chamber of Penywyrlod, Talgarth, Powys (Fig. 11.11; Table 11.4: *HAR-674*; Britnell and Savory 1984). The mixed derivation of this material suggests that it simply provides a *terminus post quem* for deposition in the monument. Further samples are being dated for this site (by Alasdair Whittle and Michael Wysocki). Occupation beneath the cairn at Gwernvale, some 15 km to the south-east, has already been dealt with above, and provides a *terminus post quem* for the tomb (Fig. 11.11: *CAR-113*). At Lower Luggy long barrow, Powys, the outer rings of two charred oak posts were dated from the ditch forming the south-east long side of the barrow, probably part of a flanking revetment (Fig. 11.11: *BM-2954–5*; Gibson 2000, 6–11; 2003). This oak is described as fast-grown, but sapwood was not identified. On the other hand, the posts were slight (0.10 m and 0.20 m in diameter respectively), although no indication is given of the methods of timber conversion. If these posts were whole timbers, then this material may be only a few decades older than the construction of the barrow and may provide a date reasonably close to the actual date of construction.

Dates have also been obtained from other monuments in a programme stemming from a project to investigate human remains from the long cairns (Wysocki and Whittle 2000). At Pipton, Powys (Savory 1956), six samples have been dated: five disarticulated human bones from different individuals and a cattle horncore from the forecourt. These relate to the use rather than the construction of the monument. At Parc le Breos Cwm, on the Gower peninsula, 12 measurements have been obtained from different individuals deposited in the chambers and passage (Whittle and Wysocki 1998). Two of these (OxA-6495 and -6497) relate to later deposition in the passage and so are not included in the model. There may be some grounds for thinking that they may have been excavated from Cat Hole Cave, which is nearby, and reburied in the tomb with the other human remains by its Victorian excavators. The other results form a coherent group, with perhaps one later outlier from the SW chamber (OxA-6489). This measurement has not been included here as part of the primary phase of burial in the cairn. At Ty Isaf, Powys (Grimes 1939), seven radiocarbon determinations have been obtained on human bone (Table 11.4). Statistically consistent replicate measurements were obtained on an adult right humerus from the passage of the rotunda ($T'=0.0$; $T'(5\%)=3.8$; $\nu=1$). The other five dates were obtained from different individuals. Two of these (Table 11.4: OxA-14250 from the upper level of the central compartment of the rotunda, and OxA-14248, from the lower level of the same area) seem to relate to later use of the rotunda in the first half of the third millennium cal BC. They have therefore been excluded from the modelling.

The model shown in Figs 11.10–11 treats each date from different individuals deposited in these three long cairns as information contributing to the overall chronology of the early Neolithic in the Marches and south Wales. It does not attempt to estimate the dates of use of each of these monuments. Separate models have been constructed to estimate these specific chronologies (Figs 11.12–14). At Pipton, the dated samples suggest that deposition in the chambers began in *3920–3645 cal BC* (*95% probability*; Fig. 11.12: *start Pipton*), probably in *3775–3660 cal BC* (*68% probability*). This deposition ended in *3490–3090 cal BC* (*95% probability*; Fig. 11.12: *end Pipton*), probably in *3460–3300 cal BC* (*68% probability*). When considering these results, it is important to note the possibility, raised by examination of the remains by Michael Wysocki, that bone groups C and D in chamber II could have been curated or

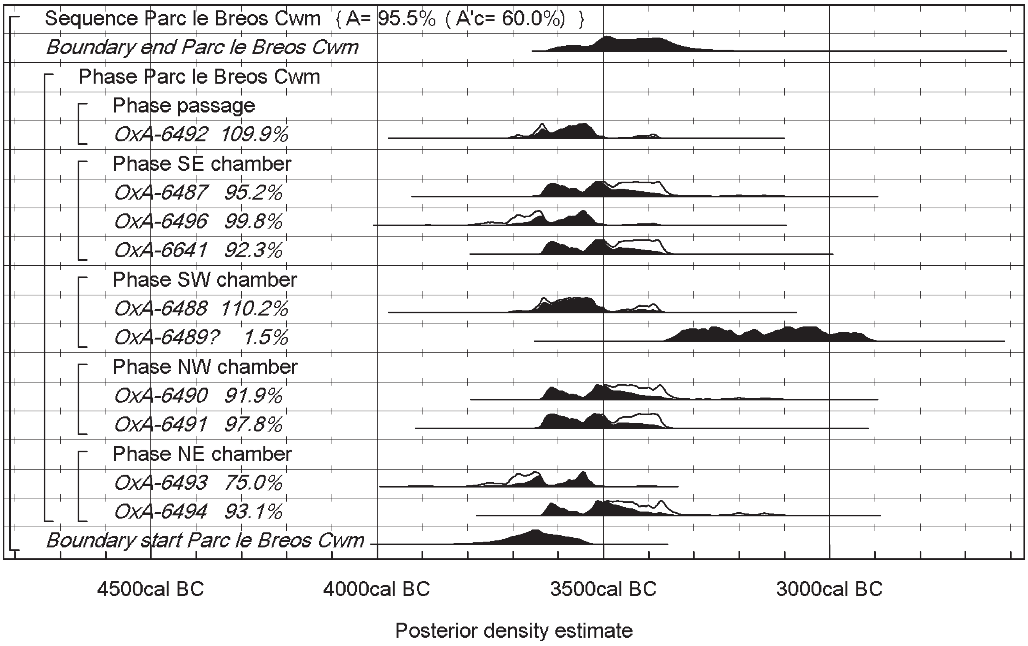

Fig. 11.13. Parc le Breos Cwm. Probability distributions of dates for the primary burials. The format is identical to that of Fig. 11.3. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

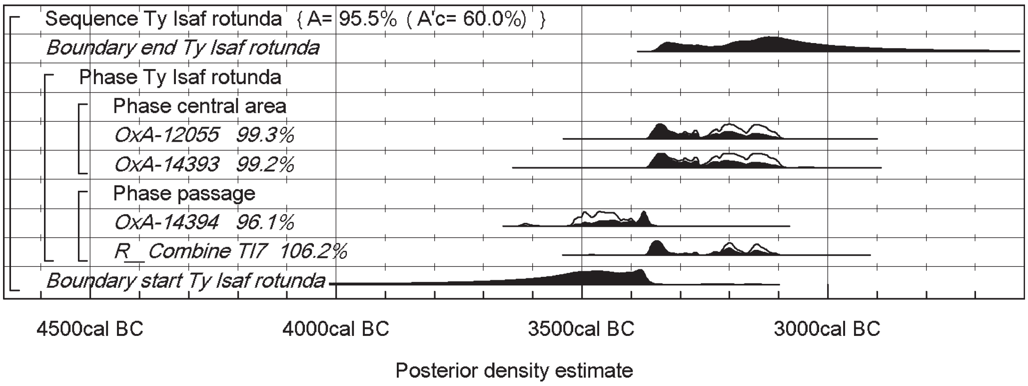

Fig. 11.14. Ty Isaf. Probability distributions of dates from the rotunda. The format is identical to that of Fig. 11.3. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

collected from elsewhere. At Parc le Breos Cwm, the model suggests that deposition began in *3780–3530 cal BC* (*95% probability*; Fig. 11.13: *start Parc le Breos Cwm*), probably in *3705–3580 cal BC* (*68% probability*). The principal phase of deposition appears to have ended in *3615–3295 cal BC* (*95% probability*; Fig. 11.13: *end Parc le Breos Cwm*), probably in *3515–3350 cal BC* (*68% probability*). At Ty Isaf, burial in the rotunda began in *3855–3355 cal BC* (*95% probability*; Fig. 11.14: *start Ty Isaf rotunda*), probably in *3575–3365 cal BC* (*68% probability*). The principal phase of deposition appears to have ended in *3355–2765 cal BC* (*95% probability*; Fig. 11.14: *end Ty Isaf rotunda*), probably in *3340–3260 cal BC* (*13% probability*) or *3210–2995 cal BC* (*55% probability*).

It is worth remembering that 'rotunda' is a term first applied to this monument in the 1930s (Grimes 1939), and it has remained in the literature ever since, with important connotations for some authors (e.g. Darvill 2004a; Pailler and Sheridan 2009) of possible early date. For Ty Isaf itself, Timothy Darvill has proposed the term 'simple passage grave' rather than rotunda (2004a, 59–60), and floats the possibility that this is another potentially early form of construction. The results presented here, however, do not suggest a particularly early date in the Neolithic sequence of the region, though we have dated use rather than construction of the monument and, in this particular case, the chamber in the rotunda would have remained accessible after the construction of the long cairn, if, indeed, they were built sequentially (Grimes 1939, fig. 3). Other dates are pending from Tinkinswood, in the Vale of Glamorgan.

A single sample of oak charcoal from immediately above the primary silt of the east ditch of the Sarn-y-bryn-caled cursus, Powys (Gibson 1994), yielded a date of *3945–3635*

cal BC (Fig. 11.10: *OxA-3997*), probably of *3895–3880 cal BC* (*2% probability*) or of *3800–3650 cal BC* (*66% probability*). This sample provides a *terminus post quem* for the early use of the monument. Radiocarbon dates for the Hindwell cursus in the Walton basin, Powys, were obtained too recently for inclusion in this project.[3]

For this project, we have not modelled radiocarbon measurements from early Neolithic sites in north Wales, but it is worth briefly noting some of the salient ones. The Bryn Celli Wen enclosure on Anglesey may be of early Neolithic date (Edmonds and Thomas 1993; J. Thomas 2001). Unfortunately, no suitable samples could be located to help this project (thanks are due to Julian Thomas for searching). A few more radiocarbon dates from pits in north Wales also indicate a fourth millennium cal BC inland presence, for example at the Brenig (F. Lynch 1993, 17–32, 214–5). Two early Neolithic houses, as well as various hollows and pits, have now been discovered at Llandygai, just outside Bangor at the east end of the Menai Strait (Lynch and Musson 2001; Kenney and Davidson 2006; cf. Kenney 2009). Radiocarbon measurements on oak charcoal from the tripartite, 13 m-long House B1, associated with plain Bowl pottery, some shouldered and with fairly heavy rims (Lynch and Musson 2001, 27–36) provide *termini post quos*, possibly for the second phase of the structure, since there was evidence for post replacement (Lynch and Musson 2001, 121–3). A charred hazelnut shell from the packing of one post, however, is dated to 3720–3520 cal BC (95% confidence; Table 11.4: GrA-20012). If the shell was neither redeposited nor intrusive, its age could be close to that of the building. Wider excavation in advance of further planned development has led to the discovery of the second, 12-m long, house at Parc Bryn Cegin, some 500 m distant, where Group VII rock from Graig Llwyd was worked (Kenney and Davidson 2006; Kenney 2009).[4] A further early Neolithic house, 16 m long, has come to light at Parc Cybi near Holyhead (Jane Kenney, pers. comm.).

A model incorporating all the radiocarbon dates (with the exception of those from Womaston which came too late to be modelled in this project) from the Marches and south Wales which are associated with diagnostically Neolithic material or architecture is defined in Figs 11.10–11. This suggests that the Neolithic in this region began in *3765–3655 cal BC* (*95% probability*; Fig. 11.10: *start S Wales & Marches*), probably in *3725–3675 cal BC* (*68% probability*). The model estimates that this phase of activity, associated for example with Bowl pottery, ended in *3350–3260 cal BC* (*95% probability*; Fig. 11.10: *end S Wales & Marches*), probably in *3340–3300 cal BC* (*68% probability*).

The extent of enclosure building in the region under discussion here is made particularly uncertain by the fourth millennium cal BC date of the apparently single-entranced enclosure at Hill Croft Field, which on the evidence of its plan was considered later prehistoric, and the first millennium cal BC date of the enclosure with causeways at Beech Court Farm, which on the evidence of its plan was considered Neolithic. There are, furthermore, other indications that earlier fourth millennium cal BC enclosures in the region took many forms, in addition to the largely uninvestigated causewayed enclosures listed above. A small sub-trapezoid enclosure, 40 m across and with a single entrance giving on to the Lower Luggy long barrow, is dated by measurements on two fragments of hazel twig charcoal from a deposit on the base of one terminal (Table 11.4: Beta-177037, -206282; Gibson 2006). A third sample, from the middle silts of the ditch, was redeposited (Table 11.4: Beta-206283). These dates suggest that the Lower Luggy enclosure was constructed in *3640–3490 cal BC* (*81% probability*; Fig. 11.15: *build Lower Luggy*) or *3470–3395 cal BC* (*14% probability*), probably in *3635–3510 cal BC* (*68% probability*). It is one of several morphologically similar sites in the Marches.

Farther east, in the valley of the Warwickshire Avon at Church Lawford, a larger two-entranced sub-trapezoid enclosure, of almost 0.80 ha, may also belong to this period (Palmer forthcoming). There is a single Neolithic Bowl sherd from a lower fill, and others from pits. From an upper fill came two statistically inconsistent measurements (Table 11.4: SUERC-3385, Wk-14819; $T'=10.3$; $T'(5\%)=3.8$; $\nu=1$). The later of these provides a *terminus ante quem* for construction of *3370–3105 cal BC* (*95% probability*; Fig. 11.15: *taq Church Lawford*), probably of *3365–3260 cal BC* (*54% probability*) or *3240–3195 cal BC* (*14% probability*). The significance of the Avon and its tributaries is reinforced by finds of plain Bowl pottery, some of it carinated, from a gully and pits at two different sites in King's Newnham, Warwickshire (S. Palmer 2003; forthcoming), in one of several pits at Baginton, Warwickshire (Hobley 1971), and of plain and decorated Bowl in Warwick itself (Woodward 1992).

Also on the Avon terraces, an open, C-plan enclosure with a few causeways at Wasperton, Warwickshire, yielded Ebbsfleet Ware and probably dates to the later fourth millennium cal BC (Hughes and Crawford 1995). Much farther west, there are other candidates in the Preselis for enclosures of Neolithic date, tentatively identified by their interrupted earthworks (Darvill and Wainwright 2002, 623). Farther west again, near St David's, Clegyr Boia is another candidate for a small, stone-walled, early Neolithic enclosure. The evidence is uncertain; early Neolithic occupation directly underlies an enclosure rampart of small stone rubble and soil within a revetment of stone blocks, but two charcoal samples, thought to be from the Neolithic occupation, were radiocarbon dated to the first millennium cal BC (Vyner 2001). The enclosure is, however, smaller than probable Iron Age examples in the area. On this basis of size, nearby Clawdd y Milwyr, on St David's Head, and Castell Coch, Trevine, might also be Neolithic (Vyner 2001; and see Chapter 10 for potentially comparable sites in Cornwall). There could thus be an even greater diversity of fourth millennium cal BC enclosures in the region than that established by the dating presented here.

A chronological model for the enclosures in this region is shown in Fig. 11.15. This suggests that the first enclosure here was constructed in *3710–3515 cal BC* (*95%*

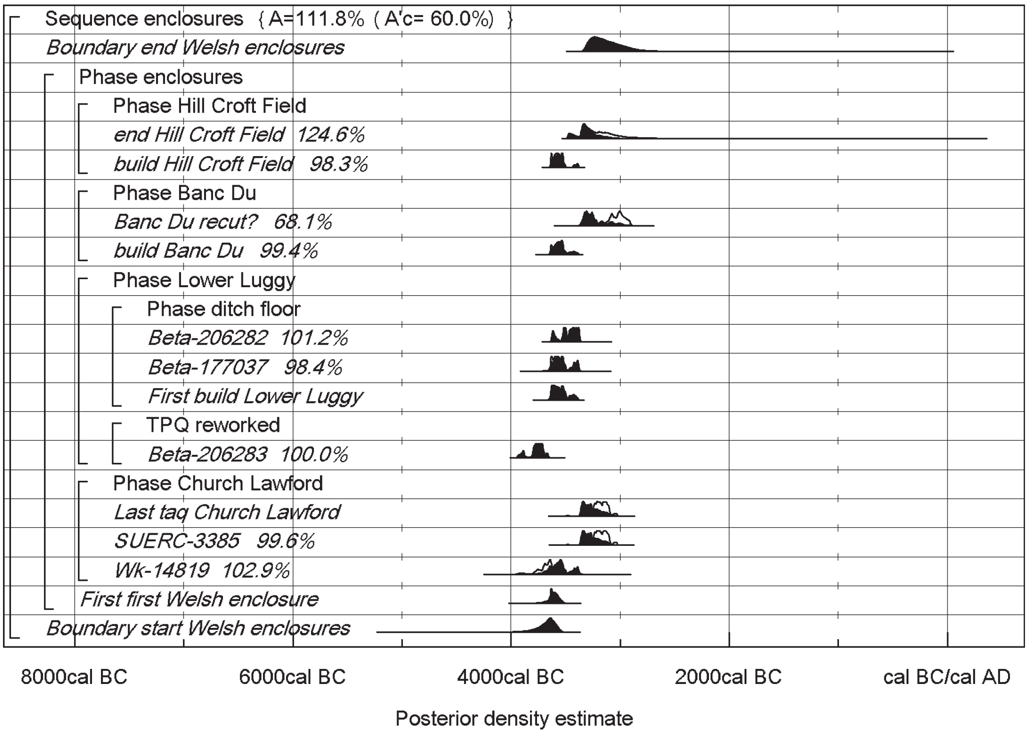

Fig. 11.15. South Wales and the Marches. Probability distributions of dates from Neolithic enclosures. Distributions for Hill Croft Field derive from the model defined in Fig. 11.3; those for Banc Du derive from the model defined in Fig. 11.8. The format is identical to that of Fig. 11.3. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

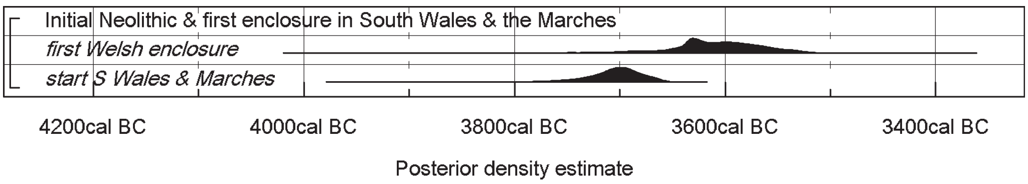

Fig. 11.16. South Wales and the Marches. Probability distributions of dates of the first dated Neolithic enclosure and of the start of Neolithic activity in this region. The distributions are taken from the models defined in Fig. 11.15 and Figs 11.10–11 respectively. The format is identical to that of Fig. 11.3.

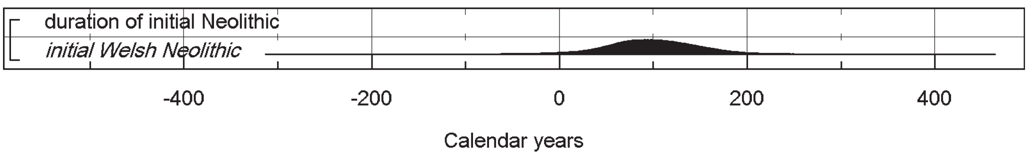

Fig. 11.17. South Wales and the Marches. Probability distribution of the number of years between the start of the Neolithic and the date of the first enclosure in this region (derived from the difference between the two distributions shown in Fig. 11.16). The format is identical to that of Fig. 11.3.

probability; Fig. 11.15: *first Welsh enclosure*), probably in *3645–3560 cal BC* (*68% probability*).

It should be stressed that the estimates for the date when the Neolithic began in the Marches and south Wales (Figs 11.10–11) and for the date when the first enclosure appeared (Fig. 11.15) are entirely independent of each other. Figure 11.16 shows these two distributions. It is *96% probable* that the Neolithic in this region as defined above had begun before the first enclosure was built. The first enclosure was constructed *−20–215 years* (*95% probability*; Fig. 11.17: *initial Welsh Neolithic*) after the initiation of the Neolithic in this region, probably *50–150 years* (*68% probability*) – two to six generations later.

Dates for other potentially Neolithic samples do not change these estimates substantively. Figure 11.18 shows other dates falling in the fourth millennium cal BC from south Wales and the Marches, measured on samples which were not associated with diagnostically Neolithic material

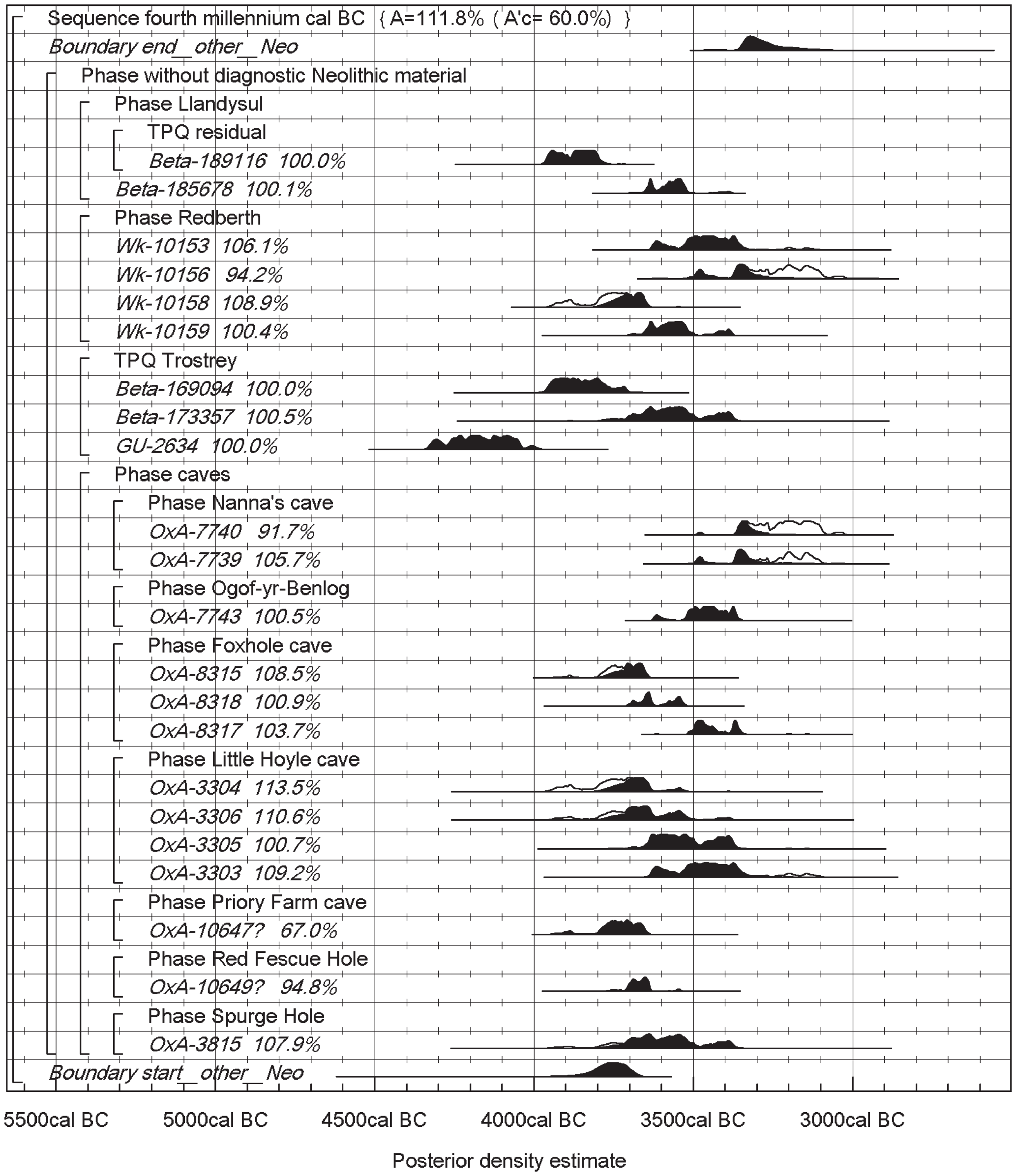

Fig. 11.18. South Wales and the Marches. Probability distributions of fourth millennium dates from contexts not directly associated with diagnostic Neolithic material. The format is identical to that of Fig. 11.3. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

or architecture as defined above. From Llandysul, already discussed above, two further fourth millennium dates were obtained. Beta-185678 came from a small isolated pit, without pottery, and Beta-189116 was redeposited in a posthole which is otherwise dated to the second millennium cal BC (Fig. 11.18; Table 11.4). Investigation in advance of bypass construction at Redberth, Pembrokeshire, revealed a series of prehistoric features. Pits, postholes and areas of burning could be identified (Page 2001). Little diagnostic material has so far been reported. Four radiocarbon dates were obtained on hazel charcoal from such contexts (Fig. 11.18; Table 11.4).

The interim reports on excavations at Trostrey Castle, Monmouthshire, summarised by Mein (2003), suggest that it included Neolithic constructions. These seem to have included a row of three posts each about 0.40 m in diameter, charcoal from one of which provided the sample for Beta-169094 (Mein 2002). North of the row was a pear-shaped, stone-kerbed mound or platform some 10 m long, twig charcoal from beneath which is reported as yielding a date in the first quarter of the fourth millennium cal BC, although the actual radiocarbon result is not cited (Mein 2003: Beta-184103). Embedded in this feature were a central post-built structure, seen as an excarnation table, and a lateral cluster of five posts, charcoal from one of which is reported to date to the first quarter of the fourth millennium cal BC (Beta-155429; no actual radiocarbon result cited; Mein 2001; 2002). North of the mound or platform was the post-built façade and two post rows leading to cremation pyres described above. Identification of the undated part of the sample for Beta-173357, from Pyre 3, as narrow roundwood from shrub species by

Rowena Gale (Mein 2003, 67), suggests that the date may be close in age to its context. Charcoal from another pyre, on top of which was a sherd described as Grimston Ware, is reported as dating to the mid-fourth millennium (Beta-184101), although the actual measurement is again not reported (Mein 2003). The three radiocarbon dates for which we have radiocarbon ages and which are not certainly associated with diagnostic Neolithic material are included in the model shown in Fig. 11.18 as *termini post quos* for their contexts (Beta-169094 and -173357, and GU-2634). This may prove an overly conservative interpretation, but is forced on us by the currently limited information available about this potentially important site.

A series of fourth millennium radiocarbon dates have been obtained on human remains from caves along the south Welsh coast (Schulting and Richards 2002a). Unfortunately, two of these samples were affected by a technical difficulty in laboratory processing (OxA-10647 and -10649), and these results are probably anomalously old (Bronk Ramsey *et al*. 2004a; Bayliss *et al*. 2007a, fig. 25). For this reason, they have been excluded from the analysis.

None of the above results have been included in the model for the early Neolithic of this region, because of the lack of diagnostic associations. There is, however, good circumstantial evidence that much of this activity may indeed be Neolithic. At Llandysul there were numerous finds of Bowl pottery; and, although the same cannot be said of Redberth, there is so far no reported Mesolithic material there. The isotope values of the human remains from the south Welsh coast have terrestrial signatures (Richards and Hedges 1999; Schulting 1998; Schulting and Richards 2002a), and accepting for the sake of argument here that this may reflect a dietary shift proposed as associated with the initiation of farming and other practices, there is some reason to assume that the people in question can meaningfully be classed as Neolithic.

Although we do not consider these dates to be sufficiently securely Neolithic to be included in the main model (Figs 11.10–11), if they are assumed to be part of a continuous phase of activity, analogous to but separate from that defined in the main model, then this started in *3880–3665 cal BC* (*95% probability*; Fig 11.18: *start_other_Neo*), probably in *3800–3700 cal BC* (*68% probability*). This estimate is compatible with the estimate for the start of the Neolithic here produced by the main model, and may provide additional supporting evidence for a relatively late start to the Neolithic here. Further, but more ambitiously, if these results are included in the main model as Neolithic without qualification, then the Neolithic in the Marches and south Wales is estimated to have begun in *3770–3670 cal BC* (*95% probability*; distribution not shown), probably in *3735–3685 cal BC* (*68% probability*). This estimate is based on more measurements and so is slightly more precise than that provided by the main model, and is entirely compatible with it. For the reasons given above, however, we prefer the model given in Figs 11.10–11.

Our evidence for the time when the enclosures in this region went out of primary use is limited. As set out above, the ditch at Hill Croft Field may have largely infilled by the later fourth millennium cal BC (Fig. 11.3). In contrast, the ditch at Banc Du appears to have been substantially recut at this time, with activity continuing into the third millennium cal BC (Fig. 11.8). We know nothing about the later use of Lower Luggy since the two non-residual dated samples are from the ditch base. At Church Lawford, activity within the enclosure ditch appears to have continued into the later fourth millennium cal BC on the basis of the later of the two dated samples (SUERC-3385) and Peterborough Ware in the overlying layer. Radiocarbon dates for other finds of Peterborough and related wares in this region are given in Fig. 11.19 and Table 11.4. Modelling these results as part of a simple continuous phase of activity suggests that Peterborough Ware began to be used in this region in *3615–3140 cal BC* (*95% probability*; Fig. 11.19: *start Welsh Peterborough Ware*), probably in *3435–3215 cal BC* (*68% probability*). The latest deposits of this style occurred in *2915–2670 cal BC* (*95% probability*; Fig. 11.19: *end Welsh Peterborough Ware*), probably in *2900–2810 cal BC* (*68% probability*). It should be noted that the results from Cefn Bryn, Gower (Table 11.4; Ward 1987; Gibson 1995b), have not been included in this model. Some at least of these appear to be anomalously late (Birm-1238 and Birm-1236, with probabilities of 4.7% and 2.9% respectively of lying within this phase of deposition). The samples in question came from beneath a Bronze Age cairn, and it is possible that later material was incorporated into these bulk samples. Two results from Fronddyrys, Powys, have also been excluded from the model, having been earlier deemed unusable by Gibson and Kinnes (1997). These samples are from a deposit immediately below the topsoil where the taphonomy of the dated material is uncertain (Table 11.4).

Turning, finally, to other aspects of the early Neolithic in the Marches and south Wales, it is striking that, in comparison especially to Ireland (Chapter 12), and perhaps also to the south-west of England (Chapter 10), there is little definite evidence for rectangular timber structures, in addition to those at Gwernvale and Llandygai, noted above. Regardless of whether the stone-built enclosure on Clegyr Boia in Pembrokeshire is Neolithic (Vyner 2001), the hill was the site of at least two post-built structures, one of them rectangular and each associated with Neolithic artefacts, including largely open, and fairly light-rimmed shouldered bowls with rare decoration and horizontal lugs (A. Williams 1952; F. Lynch 2000, 49–51). It is possible that some of the postholes at Redberth (Page 2001; 2002) could be all that survives of such structures, but that remains to be established in more detail. Rhos-y-Clegyrn, Pembrokeshire, is another candidate, but is of uncertain date, and the excavator's identification of seven separate small structures seems sanguine (J. Lewis 1974; Page 2001). Other known structures date, with varying degrees of certainty, to later in the Neolithic sequence, such as at Cefn Caer Euni, Cefn Cilsanws, Trelystan, and Upper Ninepence in the Walton basin, and are of varied form (F. Lynch 1986; Webley 1958, Britnell 1982; Gibson 1999; Page 2001).

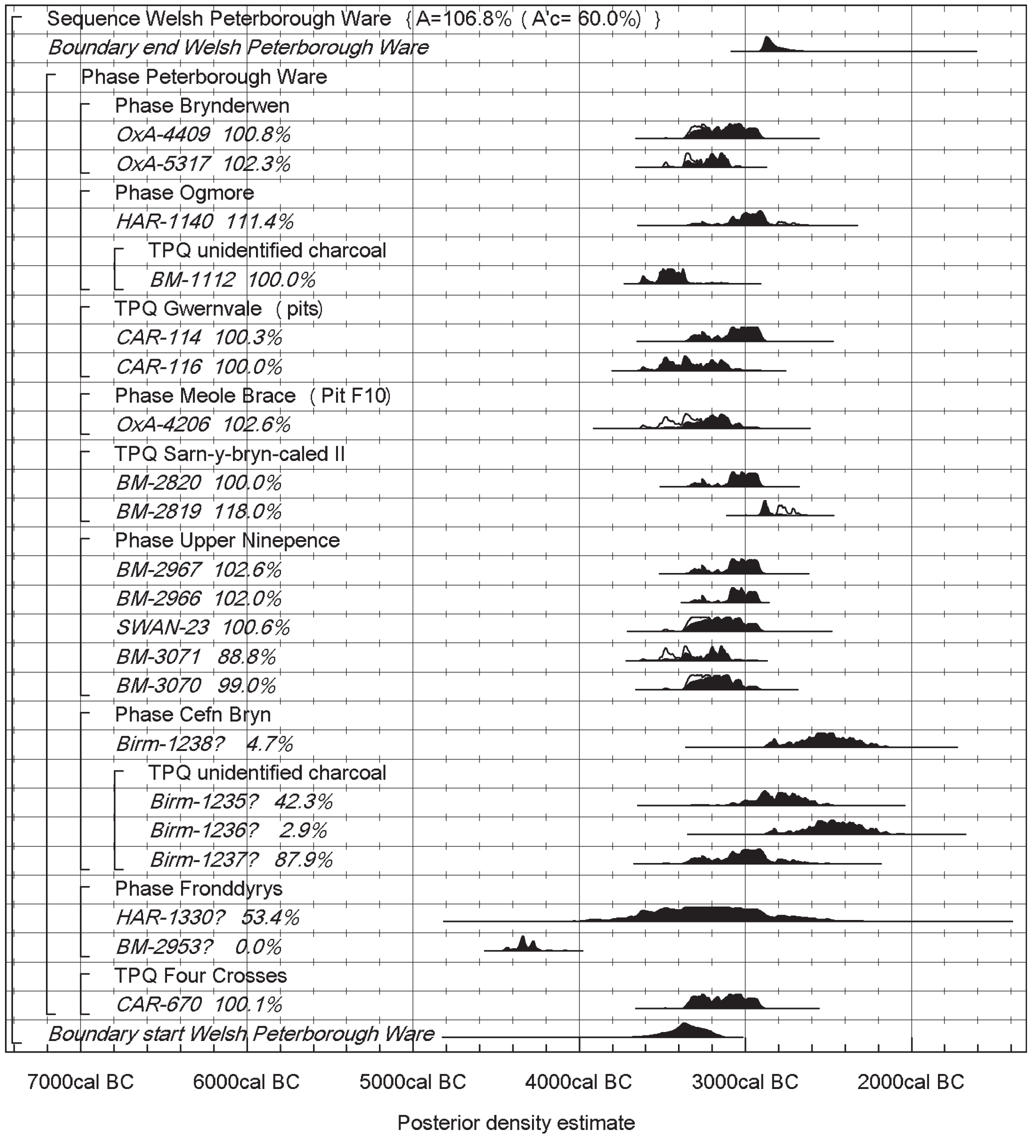

Fig. 11.19. South Wales and the Marches. Probability distributions of dates associated with Peterborough Ware. The format is identical to that of Fig. 11.3. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

This situation may of course change with further research. Two recent linear watching briefs appear, however, to have yielded no further evidence of this kind, which would now be an unusual result in Ireland. Observation of road improvements to the A55 across Anglesey did not find early Neolithic houses, despite their known presence at Llandygai on the adjacent mainland, and watching briefs in 2006 on the major gas pipeline running east from from Milford Haven to near Gloucester had a similar negative result (A. Barber *et al*. 2006).

The date estimates presented in this chapter help, as in Chapter 10, further to define the chronology of use of material culture in the early Neolithic, though with less impact than was the case for the south-west of England. Fine-grained, rhyolitic tuffs attributed to petrological Group VIII were worked in the Preselis. So far, there is evidence for the manufacture of axeheads and other products from erratics at two locations, rather than at the nearby *in situ* source of Carn Alw. The two identified working areas are unlikely to be the only ones, and the rocks worked at them showed some petrological diversity. It is possible to envisage a number of working sites, where various materials were modified (David and Williams 1995).

Most Group VIII axeheads are found around the source area of the Preselis and in eastern Wales, although small numbers have been found as far afield as eastern England; these rocks were far less extensively worked and transported than the augite granophores of Group VII, quarried in the Penmaenmawr area of north Wales (Burrow 2006a 45). Contexted Group VIII implements within the region are few. There are two axehead fragments from post-Neolithic contexts at Coygan Camp (Wainwright 1967, 161–2), although their relation to the dated pit is unknown. Another Group VIII fragment came from the Dorstone Hill causewayed enclosure in Herefordshire, but its context is unclear (cf. Olding 2000, 99). An axe-

polishing slab possibly of group VIII was placed in a pit with a cremation deposit opposite the entrance of henge A at Llandygai, the cremated bone itself dating to 3370–2930 cal BC (95% confidence; 4480±50 BP; GrA-22954). Two cord-impressed sherds, perhaps of Peterborough Ware, were also present (Lynch and Musson 2001, 43–6).

Farther afield, more confidently identified examples also tend to occur in later fourth or even third millennium cal BC contexts (I. Smith 1979). At Windmill Hill (Chapter 3), axehead fragments and flakes found by Alexander Keiller came from upper spits, in which Peterborough Ware and later pottery traditions were present, as well as from a round barrow (I. Smith 1965a, 113–14; Davis *et al*. 1988; David and Williams 1995, 453; Whittle *et al.* 1999, table 193). At Hambledon Hill, a flake came from a slot-like recut in an almost fully silted segment of the outer east cross-dyke which, although its contained artefacts were early Neolithic in character, may have been one of the last Neolithic earthworks to be built on the site (Chapter 4; I. Smith 2008b). At Downton, a complete axehead was found in an occupied area on a silt-covered terrace of the Wiltshire Avon, where the nearby pottery was mainly Peterborough Ware (Rahtz and ApSimon 1962); and, in Cranborne Chase, an axehead came from the upper fill of a pit of the early third millennium cal BC at Wyke Down henge (Barrett *et al*. 1991, 101).

Lithics were transported into the region as well as out of it (Darvill 1989). Stephen Burrow (2006b, fig. 37) has pointed out that most flint axeheads found in Wales, the majority of them from the south and east, must have been brought from areas with larger and better-quality flint than is locally available, and the most likely source area is the southern English Chalk. It is noteworthy that, as in other regions, axeheads are often of different flints from the bulk of the assemblages in which they occur, for example in the pre-cairn assemblage from Gwernvale, where some arrowheads were also of distinctive material and may, like the axeheads, have been imported as finished artefacts (Healey and Green 1984, 114). The distinction between the raw material of axeheads and other artefacts persists in the predominantly later Neolithic and Early Bronze Age collections from the Walton Basin (P. Bradley 1999, 50–1, 73). Again as in other regions, there is also evidence of the transport of flint for knapping. This was often from secondary sources rather than directly from the Chalk, as at Gwernvale (Healey and Green 1984, 114), although some of the Walton Basin lithics seem to have been made on Chalk flint (P. Bradley 1999, 50–1), as does a hoard of blade-like flakes and an edge-polished knife from Penmachno, Conwy (F. Lynch 2000, 110, pl. 6).

The model presented here (Fig. 11.10) suggests that the early Neolithic in the Marches and south Wales probably began in the late 38th or early 37th century cal BC. On this basis, we can now define the chronology of Bowl pottery in this region with greater precision. The situation may be comparable to that in the south-west of England. Most of the pottery consists of plain shouldered or unshouldered Bowls with relatively unpronounced rims (F. Lynch 2000; Peterson 2003). Some may have more accentuated shoulders and more open mouths, as at Carreg Samson portal dolmen (F. Lynch 1972), but this element appears to be in the minority and is so far at least not demonstrably earlier in this area than the dominant style.

It is clear from this review that, despite the recent discoveries reported here, there is much still to do on the early Neolithic in the Marches and south Wales in general. Overall it appears, however, that in this region too, as in south-west England (Chapter 10) and elsewhere, enclosures came later than the initiation of the Neolithic. The date of their appearance in this region conforms to that seen elsewhere in southern Britain, while the initiation of the Neolithic is not quite as early as often supposed, on the basis of the dataset modelled here, since no recognisably Neolithic activity can yet be shown definitely to belong very early in the fourth millennium cal BC.

Both results are important, and we will return to them in the wider contexts and perspectives discussed in Chapters 14 and 15.

11.5 Billown, Malew, Rushen, Isle of Man, SC 2674 7018

Location and topography

Billown lies on a low, gently rounded hilltop *c*. 40 m OD, a little inland from Castletown at the southern end of the Isle of Man (Fig. 1.1), on up to 4 m of glacial till with granite, quartzite, slate, mudstone and other erratics, which overlies Carboniferous Limestone. This is within the expanse of lower though undulating land in the south-eastern portion of the island, much of the rest of which, apart from the northern end, is dominated by upland. It lies on a narrow interfluve between the Silver Burn to the east and a stream from Chibbyr Unjin to the west, both of which run south to the sea. The longest view is to the south-west, over the coastal plain to the Irish Sea (Darvill 2001a).

History of investigation

Billown was investigated between 1995 and 2004 as a joint research, rescue and training venture by Bournemouth University and Manx National Heritage, following discoveries of Neolithic finds and features within an area designated for an expansion of limestone quarrying. Quarrying, perhaps over centuries (Darvill 2001a, 158), had clearly already impinged on the remains, truncating an extensive series of ditches (Darvill 2001a, fig. 12.2; 2003a, fig. 12.2). Excavation over eight seasons has revealed a substantial number of features (Fig. 11.20). Scattered across the excavated area of roughly 300 m by 200 m are a series of Neolithic pits, scoops and shafts of varying sizes. Some are extremely large, one reaching 6 m in diameter (Darvill 2001a, fig. 12.3). Most show evidence for lighting fires and perhaps also for cooking and eating; the model is of occasional, episodic, use (Darvill 2001a, 161). There are also undated postholes, gullies, a small

stone cairn and, nearby, a large white quartz standing stone, the Boolievane Stone. One or two Mesolithic pits have also been found. Further large scoops or hollows, earthfast jars, a 'mini-henge', and a more substantial class I henge have been assigned to the local late Neolithic Ronaldsway culture. A substantial settlement comprising at least five houses dating to *c.* 1000 cal BC lay within the excavated area, associated with a field system set out on a co-axial arrangement with some fields and paddocks in excess of 100 m across. At the north end of the site was a group of circular structures dating to the late first millennium cal BC, one certainly associated with metalworking, and the whole area is criss-crossed by early modern field boundaries which in places follow earlier alignments.

The general age of the Mesolithic and Neolithic pits does not seem problematic; they are dated by the finds they contain. Dating the ditch systems has been more of a challenge. Some contain early Neolithic material: pottery and leaf arrowheads. Another contains Ronaldsway material. Most, however, are quite narrow and shallow (Fig. 11.20), and some of this material may be residual from areas of early activity. Ongoing post-excavation analysis of the ditch fills and contents shows that the Bronze Age settlement and field system were more extensive than was appreciated during fieldwork. Interim accounts of the project used the results of geophysical surveys and available excavation results to propose the existence of a substantial D-shaped Neolithic enclosure, at least 240 m north to south and more than 220 m east to west, encompassing more than 4 ha (Darvill 2001a, 158; 2003a, 113–14). The western boundary of this enclosure can now be recognised as wholly or substantially Bronze Age in date, and by implication the same also applies to the southern boundary which is known only through geophysical survey. It is also now clear that a ditch intersection that was critical to the provisional phasing of the enclosure boundaries contains a previously unrecognised Bronze Age element.

Previous dating

Thirty radiocarbon determinations were available at the start of this project for Bronze Age and earlier material at Billown. Twelve single-entity samples were dated by AMS at the Oxford Radiocarbon Accelerator Unit using methods described by R. Hedges *et al*. (1989a) and Bronk Ramsey and Hedges (1997). The remaining 18 samples were measured by Beta Analytic Inc, using methods outlined at http://radiocarbon.com/analytic.htm. Seven samples were measured by AMS, denoted by an asterisk against the laboratory number in Table 11.5. The remainder were bulk samples dated by LSC.

Twenty-four determinations are available from discrete features, most frequently pits (Table 11.5). The dates demonstrate that pit digging and filling span the fourth to second millennia cal BC (Fig. 11.21). The two samples of fifth millennium date were of unidentified charcoal or from long-lived species of wood. These results may therefore have a significant age offset and do not confirm archaeological activity of this date; Mesolithic lithics, however, have been recovered from the site. Beta-110691 at least derived from a feature which appears to date from the second half of the fourth millennium cal BC, on the evidence of OxA-10300 from an overlying fill (Table 11.5).

Six radiocarbon measurements were available from the fills of ditches at Billown before this project (Fig. 11.22). Four of these are on unidentified charcoal or charcoal from long-lived wood species. The other two samples (OxA-11084, -10127), from F127 and F475 (Fig. 11.22), are on short-life material. If interpreted as non-residual, they suggest that this activity dates to the late third or second millennium cal BC. With single grains of cereals, on a site with considerable activity and recutting, however, there can be no certainty that these samples are not residual, and in that case they would therefore only be *termini post quos* for their contexts. We discuss this further below.

Objectives of the dating programme

The existing radiocarbon dates cast doubt on the initial interpretation, formed when the excavated area was much smaller than it finally became, of the interrupted ditches as part of an earlier Neolithic causewayed enclosure (Darvill 2001a; 2003a). Further samples of short-lived charcoal were submitted from the fills of selected features on the south-western and north-eastern sides of the putative enclosure in an attempt to clarify this interpretation.

Sampling

Six single fragments of charcoal were dated, two from each of three fills from different stretches of ditch. All the charcoal was comminuted and dispersed within the fills. GrA-31541–2 were from the lowest fill of F14, on the north-eastern boundary of the enclosure as originally proposed. The other samples were from single fills in F5206 and F5209, elements of the south-western side of the enclosure.

Results and calibration

Full details of the radiocarbon determinations from Billown considered in this chapter are provided in Table 11.5.

Analysis and interpretation

The calibrated dates from the ditches at Billown are shown in Fig. 11.23. Since all the charcoal was dispersed within the fills rather than occurring in concentrations, all the samples strictly provide *termini post quos* for the fills from which they were recovered. It is therefore difficult to estimate when particular ditch systems were laid out, especially since ditches of this small size may have been cleaned out with ease. Single dates of many periods are represented in this series, almost certainly from material reworked from the lengthy period of activity on the site

Fig. 11.20. Billown. Plan and sections. Bournemouth University School of Conservation Sciences.

Table 11.5. Radiocarbon dates from Billown, Isle of Man.

* = AMS date measured by Beta Analytic Inc.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**
Discrete pre-first millennium features						
OxA-10203		Carbonised residue on decorated pottery	1993/C214. Pit	4510±45	−27.3	3370–3020
Beta-89312		*Quercus* stickwood charcoal	Site D, F47. One of several lenses of charcoal-rich soil above clay ?hearth in pit (Darvill 1996a, 26)	5650±80	−25.0	4690–4340
Beta-110690		Substantial pieces of burnt timber, all oak	Site H, F224. Charcoal layer in shaft fill 0.90 m from top. Grain and nutshell also present	3980±60	−25.0	2830–2290
OxA-10301	ES177	Grain of *Hordeum vulgare*	Site J, F360, context 425. Large hollow/pit	3120±55	−23.5	1500–1260
Beta-129973		Stickwood charcoal	Site J, F360, context 709. Hearth in large hollow/pit pre-dating Neolithic pottery	4650±150	−25.0	3710–2910
Beta-110691		*Quercus* charcoal from one of a series of charred planks	Site K, F376. Planks overlay 2.5 m deep shaft extending from base of pit. They underlay a hearth with sherds of 3 bowls, charred cereals and hazelnut shells which provided samples for OxA-10300, -10202, -10222	5910±70	−25.0	4950–4610
OxA-10300	ES132	Charred grain of *Hordeum vulgare*	Site K, F376, context 491. Hearth in upper fill of shaft, with Neolithic Bowl pottery, charred cereals and hazelnuts stratified above sample for Beta-110691	4570±65	−23.1	3520–3090
OxA-10202		Carbonised residue from decorated pottery	From the same context as OxA-10300	4600±45	−27.8	3510–3120
OxA-10222	ES132	Charred grain of *Hordeum vulgare*	From the same context as OxA-10300	4575±55	−23.2	3500–3090
OxA-10141	ES266	Charred grain of *Hordeum vulgare*	Site K, F541, context 724. Pit	4650±39	−25.3	3630–3350
Beta-129019		Unidentified charcoal	Site L, F431, context 802. From hearth in central part of 25 m x 15 m scoop, 1.2 m from surface, cut by later pits, etc. Finds from lower levels (inc. hearth) all Neolithic	4170±90	−25.0	2930–2480
Beta-140098*		Stickwood charcoal	Site O, F605, context 1034. Central fills of scoop, charcoal associated with fragments of a polished stone axe and sherds of plain Bowl	4980±40	−26.1	3940–3650
Beta-140097		Unidentified charcoal	Site O, F623, context 1120. Hearth in 1 of series of coalescing scoops. Leaf arrowheads, scraper, flakes & blades	4600±70	−25.0	3630–3090
Beta-125767*		?unidentified charcoal fragment	F526, pit cut by ditch F496=F28=F17=F14	5680±40	−25.0	4610–4410
OxA-10140	ES192	Grain of *Hordeum vulgare*	F526, pit cut by ditch F496=F28=F17=F14	4495±40	−23.2	3360–3020
OxA-10182	ES138	Grain of *Hordeum vulgare*	F472, context 608. Scoop or pit containing early/middle Neolithic pottery, cut by ditch F68 (Darvill 1998, 11–12), upper part of fill	4930±55	−23.9	3910–3630
OxA-10245	ES133	Grain of *Hordeum vulgare*	From the same context as OxA-10182	4440±45	−23.5	3340–2910
OxA-10244	ES122	Grain of *Hordeum vulgare*	From the same context as OxA-10182	4465±45	−22.4	3360–2920
Beta-110692		Unidentified charcoal	Site K, F418. Charcoal lining of hearth/oven	2910±70	−25.0	1370–900
Beta-178341	ES939	*Alnus* charcoal	Site P, F1100, context 2001. From fill of a drain beneath structure 1, a Bronze Age round house	2810±40	−26.1	1060–840
Beta-178338	DPS 205	*Corylus*	Site P, F676, context 1553. From area of burning or temporary hearth on floor of a Bronze Age structure, a possible animal byre, next to structure 1	2780±40	−26.2	1020–820
Beta-154616*	DPS 198	*Quercus*	Site P, F694, context 1354. From pit or posthole of possible shrine next to BA settlement and approached by path from it	3010±40	−23.5	1400–1120
Beta-178339	DPS543	*Alnus*	Site P, F805, context 1915. From a lower fill of pit with large numbers of ash-rich fills, in intercutting cluster SW of Bronze Age settlement	2820±40	−27.5	1120–850

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)
Beta-178340	ES777	*Betula*	Site P, F817, context 1661. From pit containing basally retouched flake of Mesolithic type in intercutting cluster SW of Bronze Age settlement	2900±40	−25.4	1260–940
Ditches						
OxA-11084		Grain of *Hordeum* sp.	F127, context 325. Middle fill of ditch F127, stratified below sample for Beta-125766	3855±40		2470–2150
Beta-125766*		Unidentified charcoal	F127, context 163. Latest recut of ditch, with stone setting, stratified above sample for OxA-11084	3590±40	−25.2	2040–1780
Beta-125768*		Unidentified charcoal	F68, 'Earliest ditch fill'. Ditch sealed beneath cobbled surface. Cereals present	5780±40	−25.4	4730–4530
GrA-31542	DPS 21 BIL04 F14 (8)	Single fragment *Corylus avellana* roundwood charcoal, radius 10 mm, 5 growth rings	Site H, F14, context 18. Lowest fill of ditch parallel to F68 and continuing E from F28=F17 (Darvill 1998, ill. 4). Assessment of two samples (61 and 65) yielded 150 identifications, mainly of indeterminate tuber fragments but including Cerealia awns and miscellaneous seeds (Fairbairn 1999b)	3170±35	−26.0	1510–1390
GrA-31541	ES62 BIL04 F14 (8)	Single fragment *Corylus avellana* charcoal	From the same context as GrA-31542	3300±35	−24.9	1690–1490
OxA-10127	ES192	Grain of *Hordeum vulgare*	F475, context 607. Fill of ditch	3150±55	−23.2	1530–1300
GrA-31360	ES5536	*Ulex* sp. (gorse) or *Cytisus scoparius* (broom)	Site R, F5206, context 5740. Single fill of ditch, forming W boundary of enclosure N side of which is formed by F5209, F68, F28=F14, F496	1950±40	−24.9	50 cal BC–cal AD 130
GrA-31359	ES5544	Single fragment *Betula* sp. charcoal	Site R, F5206, context 5747. Single fill of ditch, forming W boundary of enclosure N side of which is formed by F5209, F68, F28=F14, F496	2415±40	−25.9	760–390
GrA-31537	ES5395 BIL04 (5314)	Single fragment *Betula* sp. charcoal	Site R, F5209, context 5314. Single fill of ditch, forming part of N boundary of enclosure with F68, F28=F14, F496	2220±35	−26.3	390–190
GrA-31540	ES5434 BIL04 Tr R F[5209] (5334)	Single fragment *Betula* sp. charcoal	Site R, F5209, context 5334. Single fill of ditch, forming part of N boundary of enclosure with F68, F28=F14, F496	2045±35	−26.3	170 cal BC–cal AD 50
Beta-154614*		*Quercus* charcoal	Site O, F619, context 1186. Ditch	4190±40	−26.1	2900–2630
Beta-154615*	ES515	Mixed charcoal	Site O, F662, context 1253. From upper fill of ditch with small amounts of struck flint but no pottery	3060±40	−24.4	1430–1210
Other contexts						
Beta-89310		Unidentified charcoal	F19. Burnt planks in IA palisade	2310±90	−25.0	750–170
Beta-89311		Unidentified charcoal	F19. Burnt planks in IA palisade	2200±90	−25.0	410–1
Beta-110689		Unidentified charcoal	F288. Fill of IA furnace or kiln	1560±60	−25.0	cal AD 380–640
Beta-140095		Unidentified charcoal	F630. Fill of IA ring ditch	2360±60	−25.0	750–260
Beta-140096		Unidentified charcoal	F647. From IA furnace	2250±40	−26.2	400–200
OxA-10128	ES276	Charred grain of *Triticum dicoccum*	Site K, F541, context 725. Pit	70±45	−23.3	cal AD 1680–1960

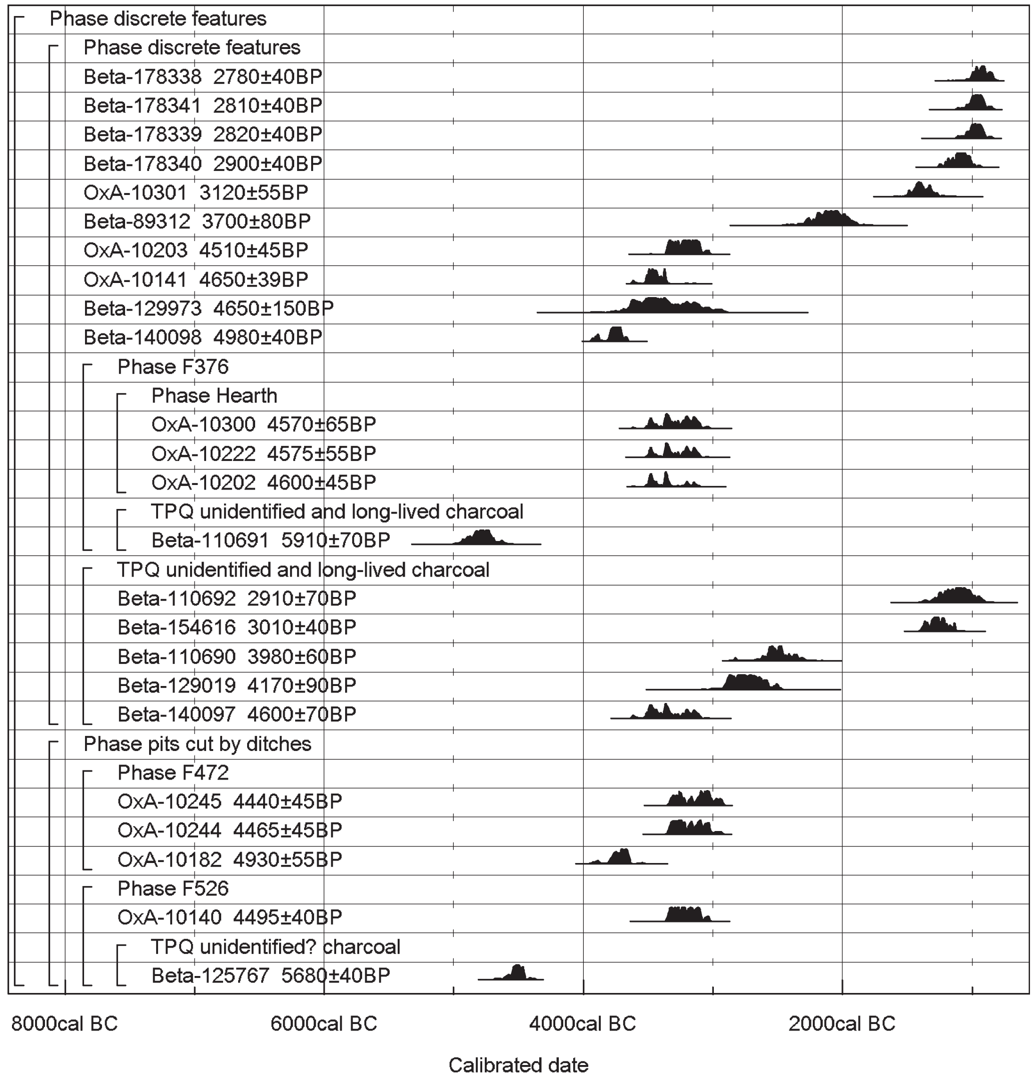

Fig. 11.21. Billown. Calibrated radiocarbon dates from discrete features (Stuiver and Reimer 1993).

evidenced by the discrete features (Fig. 11.21). Perhaps the four samples falling in the middle of the second millennium cal BC (GrA-31541–2, OxA-10127, and the *terminus post quem* Beta-154615) provide an indication of when the field system was first laid out. It may have been maintained until the end of the first millennium cal BC, as evidenced from samples from ditches F5206 and F5209.

A series of lengths of ditch which share similarities of profile and size appear to define three sides of a D-shaped block some 140 m by more than 160 m, one side of which is aligned with part of the Bronze Age system (Fig. 11.20). This is not a conventional causewayed enclosure, although the excavator feels it should be seen as an enclosure of sorts, the ditches of which surround most of the fourth millennium cal BC features revealed by excavation. All recognised sections of the ditch system in question have yielded leaf-shaped arrowheads, though these occur across the whole site in great abundance and might well be redeposited.

As now defined, the north-east side of the ditch system is represented by F1052, F400, F297, F272 and F17, all of which were shallow, less than 0.6 m deep. None of these yielded material suitable for radiocarbon dating (Darvill 1997, ill. 11; 1998, ill. 4; 2003b, ill. 3). The southern terminal of F17, however, cuts a pit, F526, a short-lived grain sample from which is dated to 3360–3020 cal BC (95% confidence; Fig. 11.22; Table 11.5: OxA-10140). This sample is a *terminus post quem* both for the pit and the ditch F17, which cuts it.

In turn, F17 is later cut by ditch F127 which itself shows several phases of recutting, the first of which is dated by a measurement, already noted above, on a short-lived grain sample to 2470–2150 cal BC (95% confidence; Fig. 11.23: OxA-11084). This can be seen as either dating the context in question or be taken as a *terminus post quem*, as discussed above. Higher in F127, in its latest recut, there is another sample, of bulk unidentified charcoal, which provides a *terminus post quem* for its context of 2040–1780 cal BC (95% confidence; Fig. 11.23: Beta-125766).

Finally in this rather packed area, the Bronze Age field boundary ditch F28/F14, short-lived samples from which are dated to 1510–1390 cal BC and 1690–1490 cal BC (95% confidence; Fig 11.23: GrA-31541–2), terminates on the edge of F127.

The south side of the ditch system in question here

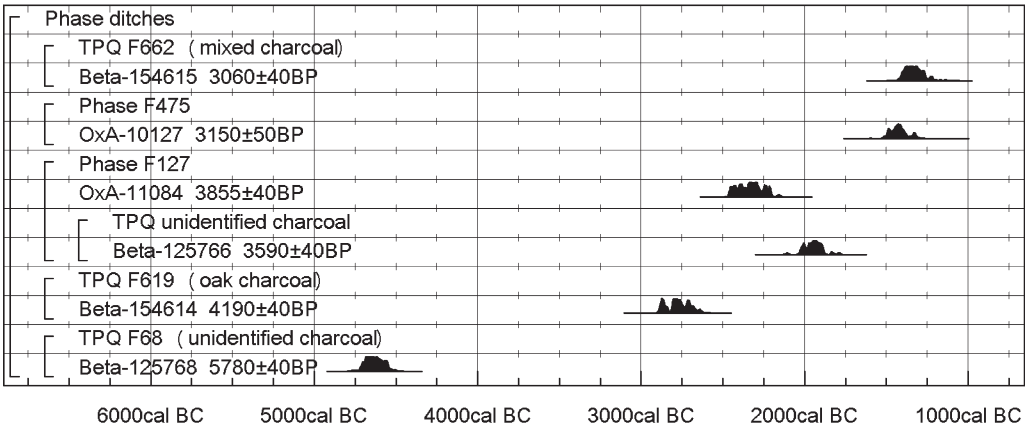

Fig. 11.22. Billown. Calibrated radiocarbon dates from ditches (Stuiver and Reimer 1993), obtained before 2005.

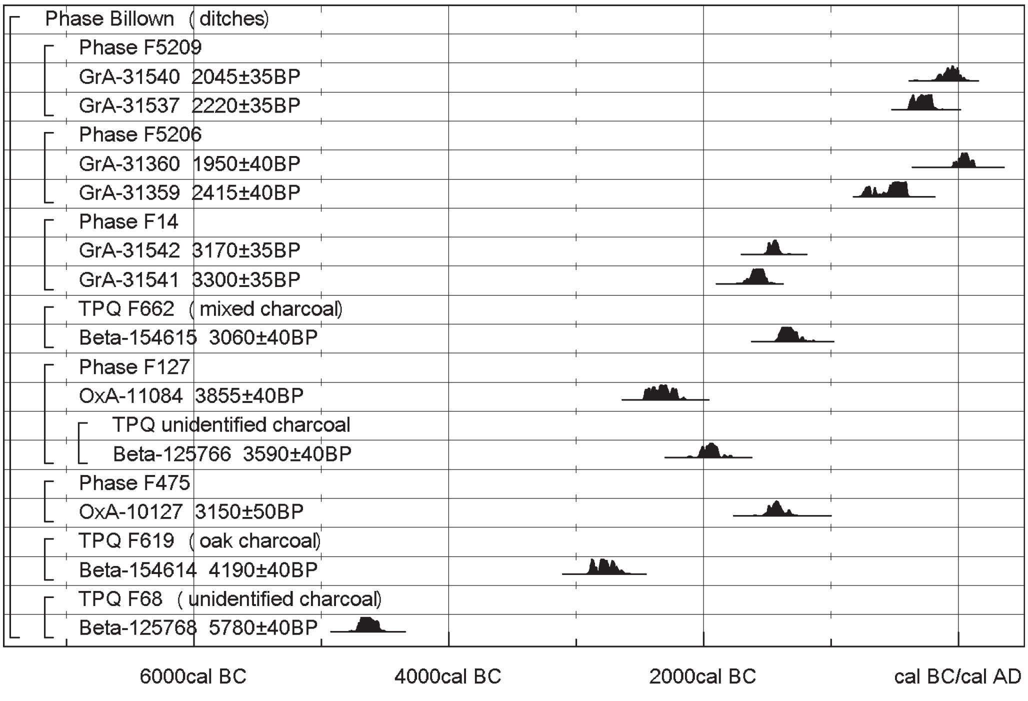

Fig. 11.23. Billown. Calibrated radiocarbon dates from ditches (Stuiver and Reimer 1993).

is represented at the eastern end by F68, securely sealed by later surfaces and, like F17, cutting pit F526, which contained the sample for OxA-10140 discussed above. A *terminus post quem* for F68 of 4730–4530 cal BC (95% confidence) is provided by Beta-125768, a sample of bulk unidentified charcoal (Fig. 11.23; Darvill 1998, ill. 4). The central section of the south side, excavated in 2004, is heavily disturbed by the presence of later Bronze Age and early modern field boundaries following more or less the same line. F5218 represents the western side of the ditch system in question, but is again fairly slight for much of its length.

Ongoing post-excavation analysis will in due course resolve some of the outstanding questions about the construction and phasing of the ditches and boundaries, and further dates may eventually be obtained when work on the environmental samples is complete. OxA-10140 (95% confidence; 3360–3020 cal BC) from F526 provides a *terminus post quem* for F17, but we simply cannot tell at present whether F17 belongs to the late fourth millennium cal BC or considerably later. If OxA-11084 (95% confidence; 2470–2150 cal BC; Table 11.5) from F127, which cuts F17, is taken as non-residual, this ditch system could have been in place by the later third millennium cal BC. But, in the absence of certainty on this point, the ditch system may be little earlier than or coeval with the Bronze Age ditch system, and could represent one of its earliest phases on the site.

The presence of a seemingly quite separate and more substantial ditch perhaps forming the south-western edge

of a second ditch system at the north end of the excavated area must also be considered a part of the overall complex (Darvill 2004c, 11–17). It contained Ronaldsway style pottery and so far only has a *terminus post quem* of 2890–2620 cal BC (95% confidence; Fig. 11.23: Beta-154614).

The Isle of Man in its fourth millennium cal BC context

The Neolithic of the Isle of Man has been, until fairly recently, comparatively under-researched (reviewed in Davey 1999; Darvill 2000a; 2004d), but a synthesis by Steven Burrow (1997), the inception of the Billown Project (Darvill 1996a), other work on settlements (Davey and Woodcock 2003), studies of rock art (Darvill and O'Connor 2005) and detailed palynological investigations (Davey and Innes 2003; Innes *et al.* 2003), especially in the north of the island, have all served to change this situation, and the island has figured prominently in recent interpretive literature (e.g. Cooney 2000a, 227; Darvill 2000a; 2003a; 2004d; C. Fowler 2001; 2002; 2004b; Cummings and Fowler 2004; Cummings 2009; Davey 2004). There is still much to do, however, including on two issues of particular concern for this volume: the nature of the Mesolithic-Neolithic transition, and the character of subsequent development. The Billown Project has made substantial contributions to both.

Mesolithic occupation of the island is well documented. An earlier microlithic industry is known, dating to as late perhaps as the seventh millennium cal BC (McCartan 1999; Davey and Innes 2003, 126). A circular post-framed structure or house dating to the seventh millennium cal BC has recently been excavated at Ronaldsway (Pitts 2009). The later Mesolithic industry is based on heavy blades, with notched butted artefacts, and relates clearly to contemporary industries in northern Ireland (Woodman 1978a; 1978b; McCartan 1994; 2000; Davey and Innes 2003). The heavy-blade site of Rhendoo, Jurby, is probably of fifth millennium date (McCartan 1994; Davey and Innes 2003, 123). The development from the earlier microlithic industry to the heavy-blade one is unclear; it has even been mooted that there could have been a break in occupation between the two phases (Davey and Innes 2003, 126). On the basis of claimed pre-elm decline cereal-type pollen and other indicators of slight vegetational disturbances at Ballachrink in the north of the island, radiocarbon dated to the early fifth millennium cal BC (Innes *et al.* 2003), the radical hypothesis has been formulated that 'heavy-bladed Mesolithic people' were arable farmers, 'possibly from the beginning' (Davey and Innes 2003, 125). The claim of very early cereal cultivation is discussed in more detail in Chapter 15, in the wider context of western Britain and Ireland. Suffice it to say here that this interpretation of the evidence seems unconvincing, both in the north of the Isle of Man and elsewhere. There are serious questions of identification and stratigraphic integrity, and then there is the issue of why, if experimentation with cereals had begun in the early fifth millennium cal BC, it was not continued, and with other, more visible palynological and archaeological effects through the fifth millennium.

In more conventional terms, there is no certain sign of the earliest Neolithic on the Isle of Man. No pottery related to the Achnacreebeag type (Sheridan 2003a; 2004; and Chapters 1, 14 and 15) has been found on the island, and no classic Carinated Bowl pottery has yet been discovered (Burrow 1997, 9). Does this just reflect the current state of still under-developed research? At present the Mull Hill (also Meayll Hill) tradition of round-based, shouldered pottery, with decorated rims, is the earliest known ceramic style on the island and can be compared with traditions in both Ireland and south-west Scotland (Burrow 1997, 11–18; Piggott 1932; Davey and Woodcock 2003). Other earlier Neolithic features such as leaf arrowheads, ground stone axes (of local, northern Irish, northern English and northern Welsh origin: Cooney 2000a, 227), long barrows or court cairns, and passage graves, are also not so far closely dated. Davey and Innes have argued (2003, 127), drawing on Burrow (1997, 9–17; 1999), that 'the cultural package that included megalithic tomb building, distinctive pottery and lithic forms cannot easily be derived from insular prototypes'. This in turn raises the question of whether a 'package' is appropriate, not least because none of the megalithic forms have been dated (Chiverrell *et al.* 1999). At this stage, one could posit either much influence and introduction from the outside, or, maintaining the importance of local continuity, a strong sense of connectedness with the outside world – or indeed both.

Herein lies perhaps the true significance of the Billown Project. Although the site has earlier been seen as an enclosure, and even compared in plan with Haddenham (Darvill 2000a, 376), our review here cannot support the existence of an earlier fourth millennium cal BC enclosure, but rather suggests a ditch system, probably a field system, mainly of second millennium date, which grew up in a place which had long been used for occupation and deposition, some, perhaps much of it, of special character. This is not to say that the Isle of Man could not have supported an earlier fourth millennium enclosure, though given the rarity of the form both in western Britain – exemplified by Banc Du in south-west Wales (this chapter), Bryn Celli Wen on Anglesey, of uncertain date and character (Edmonds and Thomas 1993), and the possible site of Green How in Cumbria (Horne *et al.* 2002) – and in Ireland as a whole (Chapter 12), the presence of one on the island would be interesting. Chapel Hill in the south of the island is a possible tor enclosure, though we know little about this site; excavations by Bersu in 1944–5 produced plentiful Neolithic flintwork, and survey by Darvill has traced the heavily eroded stone wall (Darvill 2001a, 166). But Billown remains highly significant in many other ways. Though the samples principally provide *termini post quos* for their contexts, they probably indicate a period from the earlier fourth millennium cal BC when activity became established at the site, probably in the 38th or 37th century cal BC (Figs 11.21 and 14.148: *Beta-140098, OxA-10182*). In general, the position of Billown in the centre of the Southern Plain suggests that it was a

focal point for communities occupying the fertile lands in south-western part of the island. Periodic visits involving pit digging and the veneration and elaboration of natural hollows are represented over a long period. But the evidence for early activity is slight. Beta-140098 was associated with fragments of a polished stone axe and sherds of plain Bowl which could be taken as early in the Mull Hill tradition. OxA-10182 appears to be a residual early Neolithic barley grain in a later fourth millennium pit.

What of other evidence? Environmental evidence suggests that, throughout the fourth millennium cal BC, the Isle of Man was fairly well wooded except for the higher hills; cultivation phases represented by cereal pollen and clearance indicators increase 'in frequency and intensity' in the fourth and third millennia (Davey and Innes 2003, 121). Other settlements are so far absent from the archaeological record, although pits at Phurt on the north-eastern coast (Davey and Woodcock 2003) may either be traces of occupation places or an example of a ceremonial site. Quartz mounds, a minority of which date to the fourth millennium cal BC, as at Rheast Buigh (Davey and Woodcock 2003), and about 50 panels of rock art, mainly comprising cup-marks (Darvill and O'Connor 2005), make up the majority of the remaining archaeological evidence for the period, although a fair scatter of stone axes imported from the Lake District (Group VI) and North Wales (Group VII) suggests eastward contacts with Britain (Burrow 1997; Darvill forthcoming); there are also Group IX axes from Ireland, and one jadeitite axe from Onchan, Glencrutchery, in the east-centre of the island (Cooney 2000a, 227; Coope and Garrard 1988).

Long barrows or, perhaps better, court cairns (the terminology varies: Darvill 2000a; 2003a; Davey and Woodcock 2003; Davey 2004) are known on the north-eastern part of the Island: Cashtal-yn-Ard; King Orry's Grave; Ballafayle; and The Cloven Stones. Passage graves and other related kinds of chambered tomb are more widely scattered, for example at Mull or Meayll Hill, Kew, Ballaharra, Ballaterson and Ballakelly (Darvill 2010). Chris Fowler (2001; 2002; 2004b) has drawn attention in a series of papers to the assembly of relationships that inhumed and cremated remains in these sites may project, the cremations at Mull Hill, for example, being seen as 'citations of a type of personal relationship which stressed the integration of different selves' (C. Fowler 2001, 152. At Mull Hill, 'the geography of place, path and event may have been intended to connect the deposits…with the wider world' (C. Fowler 2001, 153–4), and such deposits may also have been designed to 'keep the dead, the past and spiritual powers within the present community' (C. Fowler 2004b, 91). The views out from Mull Hill and other sites are extensive (Cummings and Fowler 2004). That wider world included the broader Irish Sea setting (Burrow 1999; Darvill 2004d, 52–3), and it has even been suggested that the island had a central role in that context, famed for its creation myths and rituals (Davey 2004, 133, 142). We know very little of the chronology of such developments. Billown, and imported axes, indicate that connections are not only to be seen in the megalithic monuments, and Billown, again, contributes significantly to the task of the construction of more reliable timeframes.

Notes

1 After this chapter was first drafted, small-scale excavations have been carried out by Clwyd-Powys Archaeological Trust in 2008, and three radiocarbon dates on charred material (in at least two cases on hazel charcoal) have been obtained from basal fills and recuts in the basal fills in the ditches (Nigel Jones, pers. comm.). These are 3650–3380 cal BC (95% confidence; 4780±40 BP; Beta-25492), 3630–3350 cal BC (95% confidence; 4650±40 BP; Beta-25493), and 3630–3350 cal BC (95% confidence; 4650±40 BP; Beta-25494). Further note added in press: see now N. Jones (2010).

2 Since this analysis, a fragment of cremated bone from the south-west part of the cairn, between the kerbstones, has been dated to 3100–2890 cal BC (95% confidence; 4361±36 BP; UB-6751; Kytmannow 2008, table 7.1).

3 Trial work was carried out by Clwyd-Powys Archaeological Trust early in 2009, and three dates obtained from different fills of the southern ditch (3950–3710 cal BC (95% confidence, 5030±30 BP: SUERC-24618; 3780–3630 cal BC (95% confidence), 4900±45 BP: SUERC-24834; and 3660–3520 cal BC (95% confidence), 4815±35 BP: SUERC-24619) (CPAT Annual Report 08/09), but at the time of writing, in 2010, details of sample composition and taphonomy are not available.

4 Chronological modelling of an extensive series of radiocarbon dates from this structure suggests that it was constructed in *3800–3670 cal BC* (*95% probability*; *start*; P. Marshall 2008, fig. 4), probably in *3760–3700 cal BC* (*68% probability*). This house was abandoned in *3690–3610 cal BC* (*95% probability*; *end*; P. Marshall 2008, fig. 4), probably in *3670–3620 cal BC* (*68% probability*). Full details of the radiocarbon dates can be found in Kenney (2009, 123–32).

12 Ireland

Gabriel Cooney, Alex Bayliss, Frances Healy, Alasdair Whittle, Ed Danaher, Lydia Cagney, Jim Mallory, Jessica Smyth, Thomas Kador and Muiris O'Sullivan

The Neolithic in Ireland is distinctive, and recent years have seen many exciting new discoveries and changes in understanding. Questions of the date when and the processes whereby the Neolithic was introduced into Ireland have been the subject of considerable discussion (e.g. Woodman 2000; Sheridan 2003a; 2003b; 2005; 2010; Cooney 2007a; Pailler and Sheridan 2009) but much remains unclear. There are relatively few known early Neolithic enclosure sites or indeed candidates for this kind of site, despite the greatly expanded spread and scale of investigation provided by the fieldwork boom of recent years. The scope of this chapter is therefore both narrower and broader than that of the others in this volume. So far, individual regions within southern Britain have been covered, as far west as south-west Wales. The Isle of Man was briefly considered as part of Chapter 11. This chapter begins with just two enclosures: Donegore Hill in Co. Antrim in the north-east of Ireland and Magheraboy in Co. Sligo in the north-west. To make sense of our date estimates for these sites, however, we turn not only to their local contexts, but also to varied aspects and features of the early Neolithic in Ireland as a whole, thereby encompassing a broader geographical sweep than has been attempted in the other regional chapters (Fig 12.1). Moreover, in order to constrain our chronological models for the early Neolithic in Ireland, we offer a model for the initiation of the middle Neolithic of the island, represented by Linkardstown burials and dated passage tombs. Although it has been suggested that the earliest passage tombs themselves form part of an initial phase of the Neolithic in Ireland and western Britain (e.g. Sheridan 2003a; 2003b), our models will suggest otherwise. These analyses represent a first attempt at providing formal, statistical models for the chronology of the early Neolithic in Ireland, using data gathered in the winter of 2006–7. Further relevant radiocarbon dates have been published since that time, but we do not believe that so far these change the patterns presented here substantively. Currently the *Cultivating Societies* project is assessing the evidence for the arrival of farming in Ireland (McClatchie *et al.* 2009), and obtaining a new series of radiocarbon dates on cereal remains.[1]

The island of Ireland is characterised by marked regional diversity, encompassing both major biogeographical differences and considerable variation at a more detailed, local level (Cooney 2000b). Our enclosure case studies belong to two such local settings, detailed further below: Donegore in upland Antrim, part of the catchment of Lough Neagh, Magheraboy on the Cúil Irra peninsula and its hinterland in coastal Sligo. The other evidence drawn on this chapter comes from many parts of Ireland, including well known areas such as the Céide Fields, Co. Mayo, The Burren, Co. Clare and the Bend of the Boyne, Co. Meath, as well as from a range of development-led projects.

In incorporating such a wide range of evidence, we are drawing on a long and varied history of research on the Neolithic in Ireland as a whole (Cooney 2000a, with bibliography). The range of enclosures of all kinds in Ireland is extensive (Sheridan 2001; Cooney 2002), and there is the possibility that more could be recognised as Neolithic in the future. For the present, after all the surveys, investigations and excavations to date, causewayed enclosures seemingly remain very scarce, the only certain examples being Donegore Hill (Mallory and Hartwell 1984; Mallory 1993; Mallory *et al.* forthcoming) and Magheraboy (Danaher 2004; Danaher and Cagney 2005; Danaher 2007). Palisade enclosures of varied kinds, known since the work at Knowth in the 1960s and 1970s (Eogan 1984) and dramatically extended at Thornhill, Co. Londonderry (Sheridan 2001; Logue 2003), may in fact be more common. A significant addition to the repertoire of enclosure forms is represented by Tullahedy, Co. Limerick (McConway 1998; Kelleher 2009).

It remains to be seen whether other, smaller earthwork- or stone-defined enclosures can be recognised in Ireland as being of Neolithic date, as seen for example in south-west England and south-west Wales (Chapters 10 and 11). The embanked enclosure at Lyles Hill, Co. Antrim, was thought by the original excavator to be Neolithic (E. Evans 1953) but was subsequently shown to be of second millennium cal BC date (Sheridan 2001, 178; Simpson and Gibson 1989). It has been suggested that the hill-top

Fig. 12.1. Ireland showing causewayed enclosures and other sites mentioned in Chapter 12.

stone-walled enclosure on Turlough Hill on the northern edge of the Burren could be of Neolithic date, since its massive single circuit, 225 m in diameter, has several interruptions (Cooney 2002; C. Jones 2004, 42–5), and aerial photographs indicate a possible causewayed enclosure west of the Knockadoon peninsula at Lough Gur (see Danaher 2007, 121). There are a number of instances where excavation has revealed Neolithic enclosures.

These include Kilshane, Co. Meath (Moore 2004; 2009) and potentially Castlefarm, Co. Kildare. Kilshane was an irregular shaped ditched enclosure, 45m in maximum external diameter. It was composed of 14 inter-connecting segments. After initial silting a series of articulated and disarticulated cattle bone deposits comprising the remains of at least 58 cattle were placed in the ditch. Further infilling and silting were followed by the placement of a middle Neolithic globular bowl in two different segments over the earlier deposits (one of them from just above and on the cattle bone).[2] A stretch of an outer segmented ditch with at least two causeways was revealed to the north-west of the enclosure (Moore 2009). At Castlefarm, limited excavation prior to development revealed three concentric ditches continuing beyond the area of excavation. They were exposed for a maximum length of 30 m and could, if part of an enclosure, have enclosed an area some 100 m across (Mullins 2000). There were a number of charcoal-rich pits with tiny fragments of burnt bone, some of them cutting the ditches. Ash charcoal from one of these, located between the middle and outer ditches, provided a date of 3970–3700 cal BC (95% confidence; 5040±45 BP; Table 12.13: OxA-7955).[3]

Donegore Hill was discovered by a combination of fieldwalking, excavation and aerial photography in the early 1980s, while Magheraboy was discovered by test trenches in 2001 and then fuller excavation in 2003, in advance of road construction. Donegore is in the kind of hill top setting which has not been much affected by the developments in infrastructure, transport and housing which have produced so many other significant discoveries in recent years, not least of early Neolithic rectangular houses (Cooney 2000a; Grogan 2004; Smyth 2006; 2007; cf. Cooney *et al*. 2006). Both the numbers and the geographical distribution of those houses have been greatly expanded. Some 80 are now known from 49 sites, and they are now scarce in only the under-researched midlands (Smyth 2006; 2007; 2011). Magheraboy, in a lowland setting, close to Sligo town, indicates the potential for further discoveries of enclosures.

12.1 Donegore Hill, Freemanstown, Co. Antrim, Irish grid reference 321440 389150

Location and topography

Donegore Hill rises to 234 m OD in the rolling country north-east of Lough Neagh in Co. Antrim (Fig. 12.1). It lies between streams which run south to join the Six Mile Water, as it flows west into the north-east corner of Lough Neagh at Antrim. Like many other early Neolithic sites, it is well inland, and locally speaking, in an upland rather than a lowland setting. There is a court tomb on the top of Browndod Hill to the north (Evans and Davies 1935).

The basalt hill itself is rounded, falling away steeply to the east and south sides; it is more stepped on the west and linked to other high ground to the north (Mallory and Hartwell 1984, 272; Sheridan 2001, fig. 13.2). The enclosure lies on a south-east-facing slope, 'tilted' off the top of the hill. Parts of the circuit follow the contours; others ignore them, and there is a marked disjunction in the line of the double circuit on the west side of the hill, seemingly coinciding with a step in the hillside (Fig. 12.2; Sheridan 2001, 174).

History of investigation

The enclosure was discovered through a research programme set up in 1981 to investigate the catchment of the Six Mile Water between Lyles Hill and Donegore Hill, in the first instance through aerial photography and field walking. Pottery and flint were found in a ploughed field on the top of Donegore Hill, which led in 1982 to more systematic collection of a considerable density of finds, and then to phosphate and magnetic survey. Excavation began in 1983, and during this season, in an unusually dry spell, aerial reconnaissance, which until then had revealed nothing on the hill, suddenly showed a series of interrupted ditches surrounding the summit; the outermost ditch was confirmed by excavation (Mallory and Hartwell 1984). A further two seasons of excavation followed (Mallory 1993).

These established that the enclosure is a circuit formed by two quite closely spaced interrupted ditches, about 3 m wide and 1 m deep, partly rock-cut, and traceable for some three-quarters of the circumference, but so far not visible on the steep south-east portion of the hill (Fig. 12.2; Mallory *et al*. forthcoming). Internal banks were detectable from the air under snow cover, though they were largely invisible on the ground except in one stretch on the north-east side. The area enclosed by the outer ditch measured some 220 by 175 m and occupied some 2.6 ha. A palisade slot usually not more than *c*. 0.5 m wide and 0.6 m deep was encountered inside the inner ditch in sectors E1, E2 and E5, and continued in sector E6 on the steepest side of the hill where no ditches or banks were identified. In sector E1, the site of a probable entrance, the palisade was double. In sector E4, exceptionally, the only palisade slot encountered was between the ditches (Figs 12.2–3; Mallory *et al*. forthcoming). A portion of an outer palisade was found in sector E1, on the west side, but it was located in only one cutting, although the outer ditch was investigated in several. In that one cutting it ran at an oblique angle to the ditch; and it may have been continuous with a linear feature observed on air photographs (Mallory *et al*. forthcoming).

A variety of ditch fills were found (Fig. 12.3), with different sequences in different parts of the circuit. Natural, probably rapid, infilling was recurrent, followed by slower silting, with some recuts and charcoal-rich lenses. In sector E2 the inner ditch had been almost completely filled with rapidly accumulated basalt rubble before it was recut (Mallory *et al*. forthcoming).

While the ditches and palisade slots contained Neolithic material, the bulk of the vast assemblage came from the ploughsoil in cuttings in the interior, which had clearly been badly damaged (Sheridan 2001, 174; Nelis 2003).

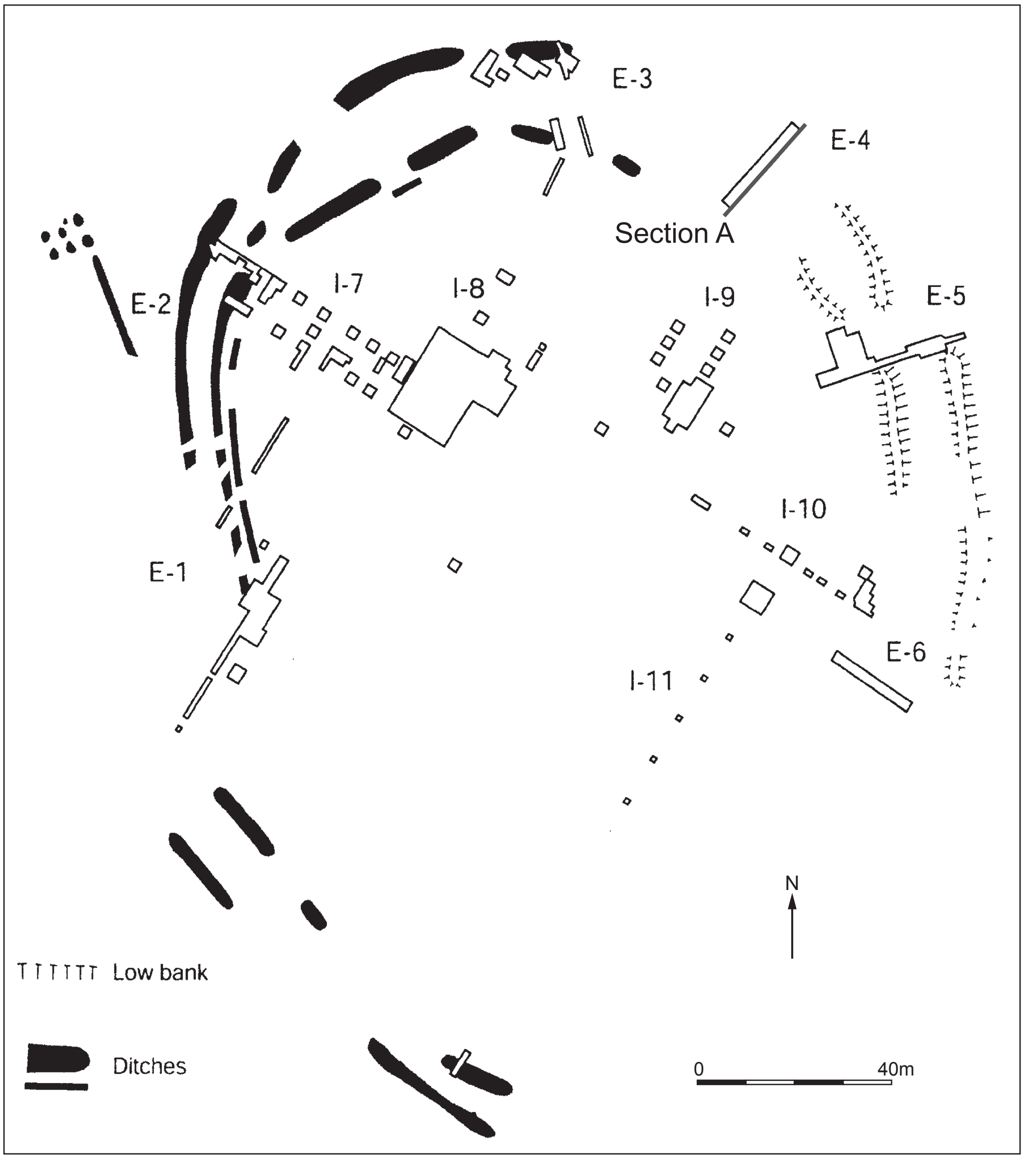

Fig. 12.2. Donegore Hill. Plan showing excavated areas. After Mallory et al. *(forthcoming).*

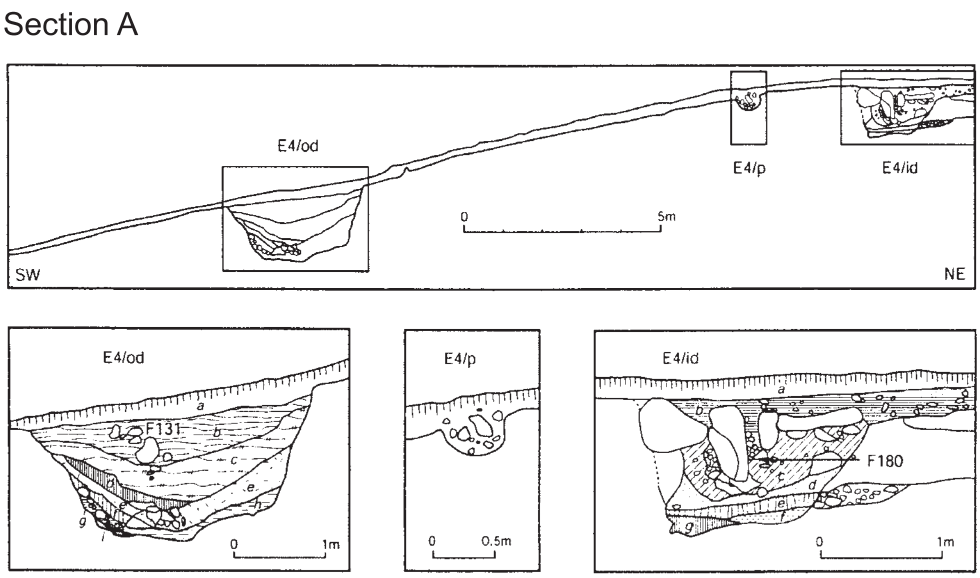

Fig. 12.3. Donegore Hill. Sections through, from left to right, the outer ditch, outer palisade and inner ditch in sector E4. After Mallory et al. *(forthcoming).*

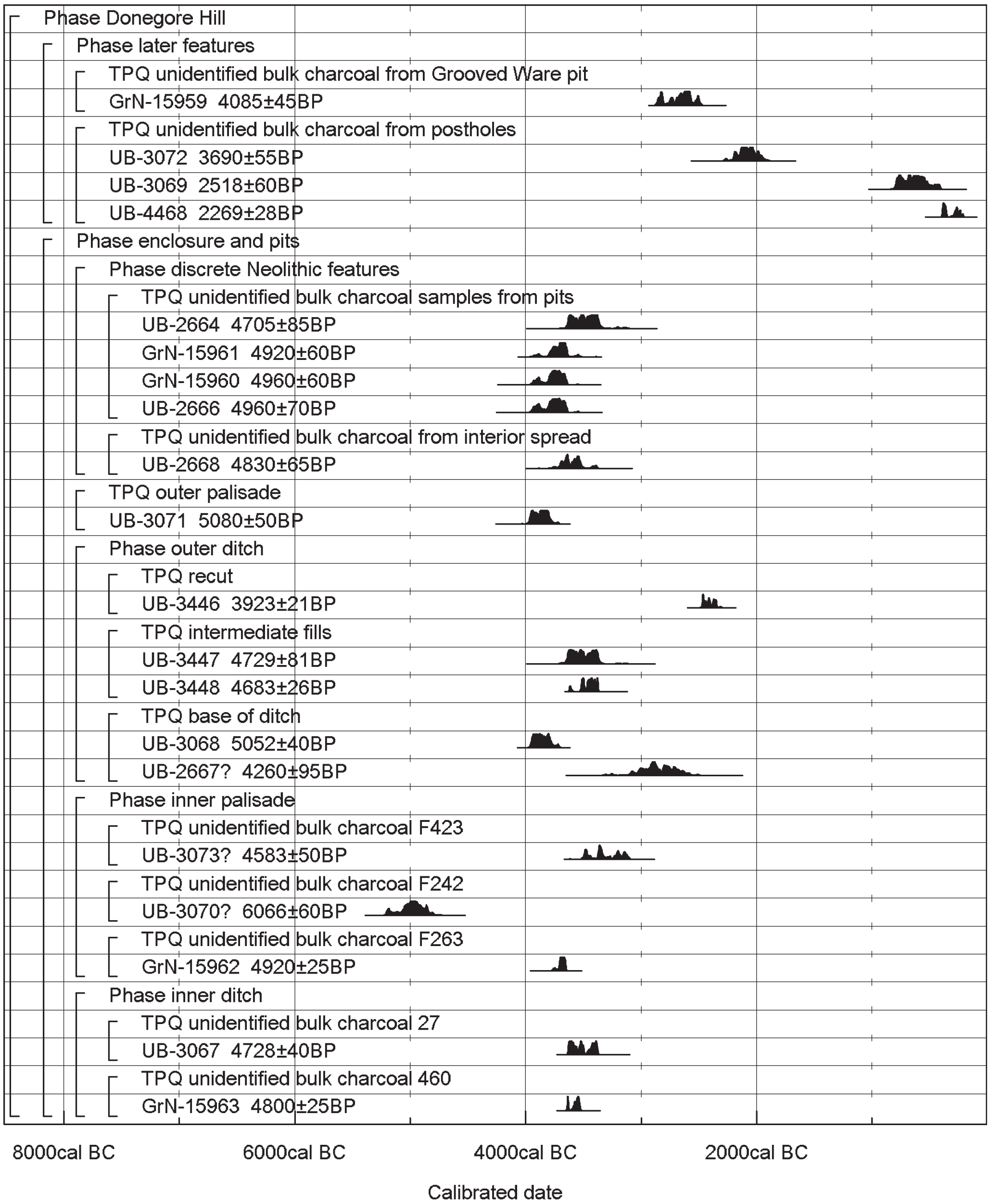

Fig. 12.4. Donegore Hill. Calibrated dates from radiocarbon determinations obtained before 2004 (Stuiver and Reimer 1993).

Several hundred postholes, pits, hearths and other features were found, some post-early Neolithic, but some of early Neolithic date. It has been estimated that least 1500 Neolithic vessels were present, represented by *c.* 45,000 sherds/*c.* 1350 kg of pottery; axeheads included examples of porcellanite from the known sources over 35 km away to the north-east (Sheridan 1995, 7; 2001, 174); and the flaked lithic assemblage amounts to 23,849 pieces (Nelis 2003). Both Carinated and unshouldered plain Bowl pottery, some of it ripple-burnished, was found in the ditches of both circuits and in pits in the interior. Charcoal, carbonised hazelnuts, cereal grains, chaff and weeds were recovered. No unburnt animal bone survived.

Previous dating

Twenty radiocarbon measurements were available before this project, all made on bulk samples of unidentified charcoal. Fifteen samples were dated at the Belfast Radiocarbon Laboratory using methods described by Mook and Waterbolk (1985) and Pearson (1984). The other five samples were similarly pretreated and dated at the University of Groningen by GPC of carbon dioxide as described by Mook and Streurman (1983).

Because the samples were unidentified bulk charcoal, all may have contained material of diverse ages and with significant old wood offsets. Each sample therefore provides a *terminus post quem* for its context. In these circumstances, the results provide only the most general

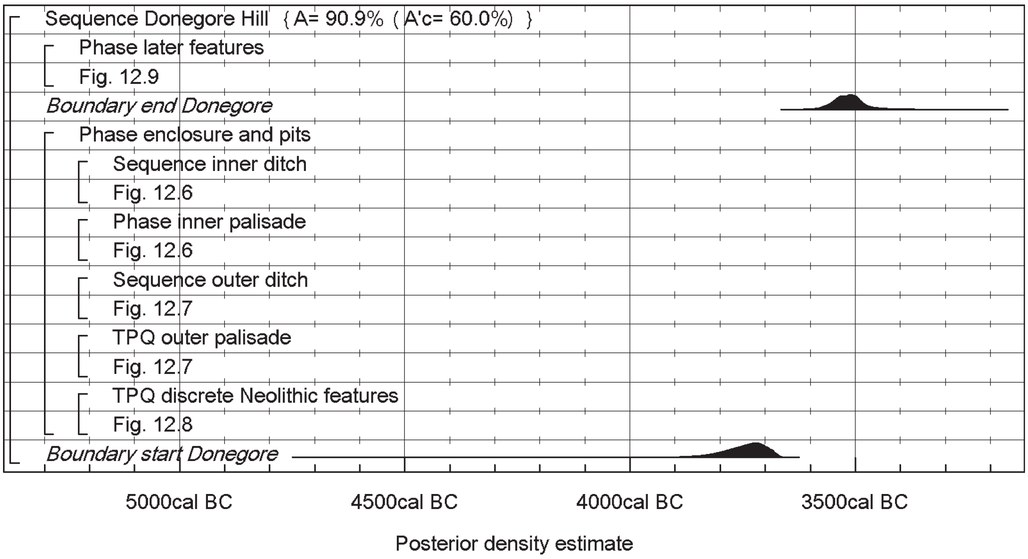

Fig. 12.5. Donegore Hill. Overall structure of the chronological model. The component sections of this model are shown in detail in Figs 12.6–9. The large square brackets down the left-hand side of Figs 12.5–9, along with the OxCal keywords, define the overall model exactly.

indication of the date of the monument. Four pits in the interior yielded fourth millennium cal BC dates (Table 12.1: UB-2664, -2666, GrN-15960–1), as did a spread of material (UB-2668). The inner ditch provided two dates (UB-3067 and GrN-15963) which fall in the mid-fourth millennium cal BC (Fig. 12.4), although neither context is primary. These have been interpreted as providing a *terminus ante quem* of *c*. 3700–3400 cal BC for construction (Mallory *et al*. forthcoming). Three dates from the inner palisade (Table 12.1: GrN-15962, UB-3070, -3073) are widely spaced in time, UB-3073 possibly suggesting a date for this structure in the later fourth millennium cal BC (Fig. 12.4). All three samples were of mixed charcoal, rather than the burnt stumps of posts. Five determinations were obtained from the fills of the outer ditch. From its base, UB-3068 and UB-2667 provided widely divergent ages. UB-2667 was probably from a recut. This recut was identified in a contiguous cutting in the year following its first excavation and was dated by UB-3446 (Mallory *et al*. forthcoming). UB-3068 is thus the only measurement from the base of the outer ditch, the remaining measurements (Table 12.1: UB-3446–8) coming from higher levels. The five have been interpreted as dating the ditch to *c*. 3800–3400 cal BC (Mallory *et al*. forthcoming). A single fourth millennium cal BC date came from the outer palisade (Table 12.1: UB-3071).

The excavator's conclusion, based on a combination of the archaeological evidence and the radiocarbon dates, was that a first phase consisted of the construction of an outer linear palisade (F272, dated by UB-3071 and more extensively traced from air photographs), soon followed by the digging of both ditches and the construction of the inner palisade. Once the ditches were infilled, a second much later phase of activity consisted of recuts and some internal features (Mallory *et al*. forthcoming).

On their own, the radiocarbon dates obtained before 2004 support the division of the site into two principal phases of activity separated by some centuries (Fig. 12.4). The suggested sequence of outer palisade and enclosure construction is, however, based on the spatial relationship of these elements, and cannot be derived from the radiocarbon dates. Because all the samples are *termini post quos* for their contexts, all the activity to which they relate may have occurred within a restricted period in the mid-fourth millennium cal BC (Fig. 12.4).

Objectives of the dating programme

The project sought to refine the existing dating of the site, by obtaining further radiocarbon measurements on short-life material.

Sampling

The relative scarcity of pottery in well stratified ditch deposits and the non-survival of unburnt bone meant that sampling was restricted to charcoal and charred plant remains, which were available thanks to large-scale flotation. It was not possible to find further samples from the outer ditch or the possible outer palisade, or from the lowest levels of the inner ditch.

Results and calibration

Details of all the radiocarbon determinations from Donegore are listed in Table 12.1.

Analysis and interpretation

The overall chronological model for the site is shown in Fig. 12.5, with its components relating to the inner ditch and palisade shown in Fig. 12.6, to the outer ditch and

Table 12.1. Radiocarbon dates from Donegore Hill, Co. Antrim. Posterior density estimates derive from the model defined in Figs 12.5–9.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Discrete Neolithic features							
UB-2664		Unidentified bulk charcoal sample	Sector I10, Tr 34, F20. Pit	4705±85		3660–3340	*3665–3480*
GrN-15961		Unidentified bulk charcoal sample	Sector I8, Tr 66, F237. Pit	4920±60		3910–3540	*3935–3870* (*5%*) or *3810–3630* (*89%*) or *3560–3535* (*1%*)
GrN-15960		Unidentified bulk charcoal sample	Sector I8, Tr 62, F61. Pit	4960±60		3950–3640	*3945–3855* (*16%*) or *3820–3640* (*79%*)
UB-2668		Unidentified bulk charcoal sample	Sector I9, Tr 20. Spread in interior of enclosure	4830±65		3710–3380	*3760–3740* (*2%*) or *3715–3515* (*93%*)
UB-2666		Unidentified bulk charcoal sample	Sector I9, Tr 25, F14. Pit	4960±70		3960–3630	*3945–3635*
GrN-15959		Unidentified bulk charcoal sample	Sector I8, Tr 62, F56. Pit containing 2 Grooved Ware pots	4085±45		2870–2480	
Inner ditch							
GrN-15963		Unidentified bulk charcoal sample	Sector E1, Tr 77, F460. Very dark grey silt 0.22 m thick with large amounts of charcoal mixed with gravel and a small quantity of pottery, deposited when ditch more than half full	4800±25		3650–3520	*3645–3620* (*23%*) or *3600–3525* (*72%*)
GrA-31328	SQ 46 /A	Single fragment *Corylus avellana* charcoal	Sector E2, Tr 46, F27. Circumscribed charcoal spread 0.12 m thick, and measuring *c.* 0.75 m x 0.30 m, in base of probable recut in segment butt. Neolithic pottery and abundant charred sheep sorrel seeds present. In segment butt opposed to that containing F77, F37, F39, F76	4785±45	−25.8	3660–3380	*3650–3520*
GrA-31330	SQ 46 /B	Single fragment *Corylus avellana* charcoal	From the same context as GrA-31328	4770±35	−26.4	3650–3380	*3640–3520*
UB-3067		Unidentified bulk charcoal sample	From the same context as GrA-31328	4728±40		3640–3370	*3640–3505*
GrA-31331	Ft 29/A	Single fragment *Betula* sp. charcoal	Sector E2, Tr 55, F29. Pit cut into fully silted inner ditch, next to and at same level as F28. South of and stratified above other samples from segment	2210±35	−26.3	390–170	
GrA-31332	Ft 29/B	Single fragment *Corylus avellana* narrow roundwood charcoal	From the same context as GrA-31331	2250±35	−26.7	400–200	
GrA-31337	AG 47 (3)/B	Single fragment *Betula* sp. charcoal	Sector E2, Tr 46, F39 (3). Small pit cut into fill of inner ditch in segment butt opposed to that containing F27. Stratified below F28–F30	2205±35	−25.4	390–170	
GrA-31336	AG 47 (3)/A	Single fragment *Betula* sp. charcoal	From the same context as GrA-31337	2230±35	−26.1	400–190	
GrA-31341	SQ 46 (3)/B	Single fragment *Corylus avellana* charcoal	Sector E2, Tr 46, F76 (3). Charcoal spread beneath large stone (F76), containing Neolithic Bowl pottery, in recut in segment butt opposed to that containing F27. Stratified below F77 and F39	4855±35	−25.5	3710–3530	*3705–3630* (*81%*) or *3580–3535* (*14%*)
GrA-31339	SQ 46 (3)/A	Single fragment *Corylus avellana* charcoal	From the same context as GrA-31341	4935±40	−26.0	3800–3640	*3750–3640*

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
GrA-31334	SQ 46 /A	Single fragment Pomoideae charcoal	Sector E2, Tr 46, F77. Circumscribed charcoal spread in segment butt opposed to that containing F27. Stratified below F28–F30 and above F76	3995±35	−27.7	2580–2460	
GrA-31335	SQ 46 /B	Single fragment *Corylus avellana* charcoal	From the same context as GrA-31334	4020±35	−25.0	2830–2460	
GrA-31324	SQ 37 /B	Single fragment *Corylus avellana* charcoal	Sector E4, Tr 37, F180, ko 10. Fill of steep-sided ?recut	4955±35	−27.5	3800–3650	*3760–3645*
GrA-31322	SQ 37 /A	Single fragment *Corylus avellana* charcoal	From the same context as GrA-31324	4930±35	−26.0	3790–3640	*3750–3640*
Inner palisade							
UB-3070		Unidentified bulk charcoal sample	Sector E1, Tr 77, F242. One of 2 palisade slots upslope from inner ditch	6066±60		5210–4800	
UB-3073		Unidentified bulk charcoal sample	Sector E1, Tr 86, F423. Palisade slot upslope from inner ditch	4583±50		3500–3100	
GrA-31320	TR 78 (2)/A	Single fragment *Corylus avellana* charcoal	Sector E5, Tr 78, F263. Basal layer of palisade slot packed with stones and a large assemblage of Neolithic pottery, sealed by 0.10 m of silt washed down from upslope	4780±35	−25.9	3650–3380	*3640–3520*
GrA-31321	TR 78 (2)/B	Single fragment *Corylus avellana* charcoal	From the same context as GrA-31320	4790±35	−25.1	3650–3510	*3645–3520*
GrN-15962		Unidentified bulk charcoal sample	From the same context as GrA-31320	4920±25		3770–3640	*3765–3720* (*10%*) or *3715–3645* (*85%*)
GrA-31326	SQ 50 (3)/B	Single fragment *Corylus avellana* charcoal	Sector E6, F22 (3). Stone-packed palisade trench on E side of hill, where no ditches identified	4805±35	−27.0	3660–3520	*3655–3615* (*27%*) or *3610–3520* (*68%*)
GrA-31325	SQ 50 (3)/A	Single fragment *Corylus avellana* charcoal	From the same context as GrA-31326	4775±35	−26.7	3650–3380	*3640–3520*
Outer ditch							
UB-3447		Unidentified bulk charcoal sample	Sector E1, Tr 77, F280. Dark brown silt with charcoal 0.10 m thick, descending on to layer of stones with a few Neolithic sherds, an upper fill of the ditch, *c.* 0.80 m above ditch base	4729±81		3660–3350	*3695–3680* (*1%*) or *3665–3490* (*94%*)
UB-2667		Unidentified bulk charcoal sample	Sector E3, Tr 24. Layer c on base of ditch, 0.20 m of orange-brown gravel, some charcoal and Neolithic bowl pottery, in cutting later extended as Tr 61. Trench 24 was opened and backfilled in 3 days in the final week of the first season's excavation, and nothing corresponding to F34, found in Tr 61 the following year, was recognised	4260±95		3100–2570	
UB-3446		Unidentified bulk charcoal sample	Sector E3, Tr 61, F34. Narrow, slot-like recut into intermediate fill extending to base of ditch, containing dark soil, charcoal and medium to large stones	3923±21		2475–2340	
UB-3068		Unidentified bulk charcoal sample	Sector E3, Tr 61, F51. Charcoal from base of ditch, below stones and gravels of lowest layer	5052±40		3970–3710	*3960–3760* (*94%*) or *3725–3710* (*1%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
UB-3448		Unidentified bulk charcoal sample	Sector E5, Tr 78, F301. Charcoal lens containing porcellanite axehead in layer of darker grey silt with coarse basalt stones overlying lowest layer of ditch	4683±26		3630–3360	*3635–3575 (63%)* or *3535–3485 (32%)*
Outer palisade							
UB-3071		Unidentified bulk charcoal sample	Sector E1, Tr 77, F272. Palisade trench converging with outer ditch	5080±50		3980–3710	*3980–3760*
Later contexts							
UB-3072		Unidentified bulk charcoal sample	Sector I8st, Tr 80, F296. Posthole of stockade on summit	3690±55		2280–1920	
UB-3069		Unidentified bulk charcoal sample	Sector I8cs, Tr 62, F130. Posthole of penannular post-built structure on summit	2518±60		810–400	
UB-4468		Unidentified bulk charcoal sample	Sector I8cs, Tr 62, F111. Posthole of penannular post-built structure on summit	2269±28		400–210	

possible palisade in Fig. 12.7, to discrete interior features in Fig. 12.8 and to later features in Fig. 12.9.

The inner ditch. There were neither suitable samples nor pre-existing measurements from the lowest levels. The dated samples are from upper fills and recuts, most of them scattered around the circuit without stratigraphic relation to each other. In sector E1, an unidentified bulk charcoal sample (Fig. 12.6: *GrN-15963*) comes from the charcoal-rich layer F460, deposited when the ditch was more than half full. This result is treated as a *terminus post quem* for the layers above it. In sector E4, two statistically consistent measurements (Fig. 12.6: *GrA-31322, -31324*; T'=0.3; T'(5%)=3.8; ν=1) were made on short-life samples from a probable recut, F180, made when the ditch was almost fully silted (Fig. 12.3). In trench 46 of sector E2, the opposed butts of two segments were excavated. F27, a discrete charcoal spread in a recut made into a rapid accumulation of basalt rubble in one butt, yielded two short-life samples (Fig. 12.6: *GrA-31328, -31330*) and an unidentified bulk sample (Fig. 12.6: *UB-3067*). These provide statistically consistent measurements (T'=1.0; T'(5%)=6.0; ν=2). Because the unidentified sample is statistically consistent with the two short-life samples, the model treats it as close in age to this deposit. In the butt of the other segment, which was also more than half-filled with rapidly accumulated basalt fragments, a sequence of samples was dated from a further recut. The lowest of these was a charcoal spread, F76(3), from which there were two short-life samples which provided further statistically consistent measurements dating to the second quarter of the fourth millennium cal BC (Fig. 12.6: *GrA-31339, -31341*; T'=2.3; T'(5%)=3.8; ν=1). Samples from overlying contexts were submitted in the expectation that they too would date to the fourth millennium cal BC. In the event, however, two short-life samples from F77, a charcoal spread overlying F76, provided statistically consistent measurements in the early third millennium cal BC (Fig. 12.9: GrA-31334–5; T'=0.3; T'(5%)=3.8; ν=1); and two further short-life samples from pit F39, which was cut into the ditch, dated to the first millennium cal BC (Fig. 12.9: GrA-31336–7; T'=0.3; T'(5%)=3.8; ν=1). In Trench 55 in the same sector, 5 m to the south-west, two further short-life samples from F29, a scoop cut into the top of the silted ditch, also dated to the first millennium cal BC (Fig. 12.9: GrA-31331–2; T'=0.7; T'(5%)=3.8; ν=1). These later features do not form part of the initial construction and use of the enclosure but demonstrate that its earthworks remained visible and were a focus for later activity.

On this basis, the construction date for the inner ditch can be estimated as *3810–3660 cal BC* (*95% probability*; Fig. 12.6: *build inner ditch*), probably *3750–3675 cal BC* (*68% probability*). As no samples have been dated from the base of the ditch, it is possible that the circuit was dug slightly earlier than this. It would be difficult to argue for an extended interval, since both sector E2 F27 (the source of the samples for UB-3067, GrA-31328 and -31330) and sector E2 F76 (the source of the samples for GrA-31339 and -31341) directly succeeded undifferentiated fills of basalt rubble which had accumulated rapidly on the ditch base.

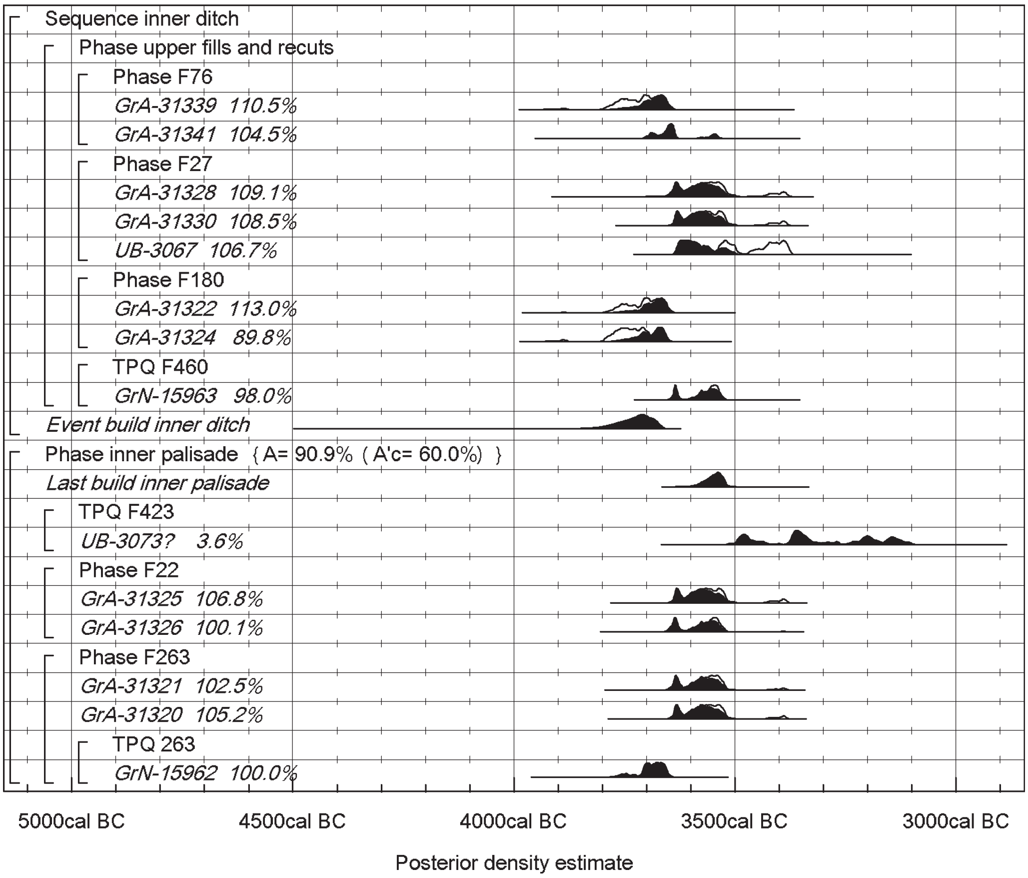

Fig. 12.6. Donegore Hill. Probability distributions of dates from the inner ditch and palisade. Each distribution represents the relative probability that an event occurred at a particular time. For each of the dates two distributions have been plotted, one in outline which is the result produced by the scientific evidence alone, and a solid one which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution 'build inner ditch' is the estimated date when the inner ditch at Donegore was dug. Dates followed by a question mark have been calibrated (Stuiver and Reimer 1993), but not included in the chronological model for reasons explained in the text. The overall structure of this model is shown in Fig. 12.5, and its other components in Figs 12.7–9.

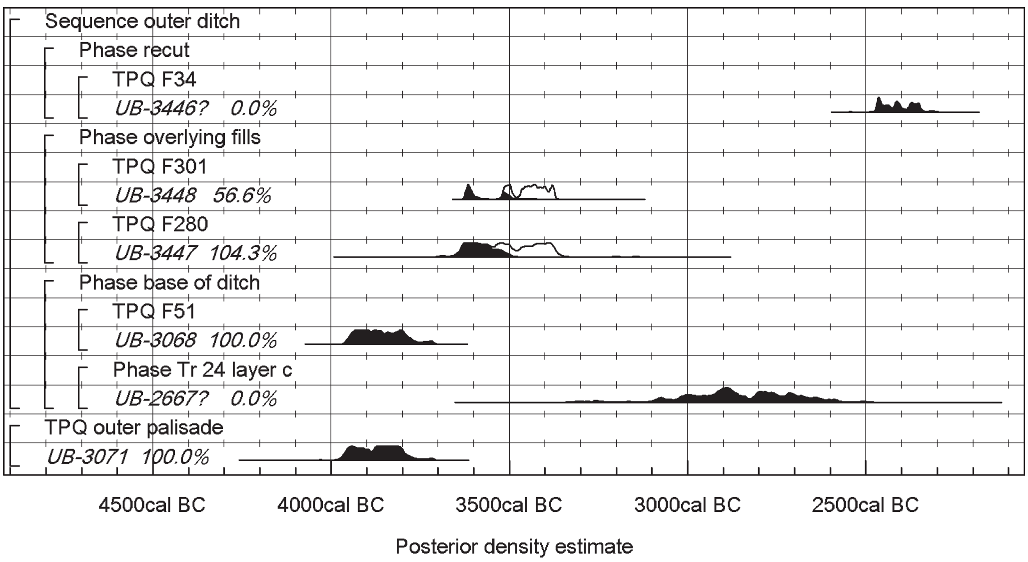

Fig. 12.7. Donegore Hill. Probability distributions of dates from the outer ditch and palisade. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.5, and its other components in Figs 12.6 and 12.8–9.

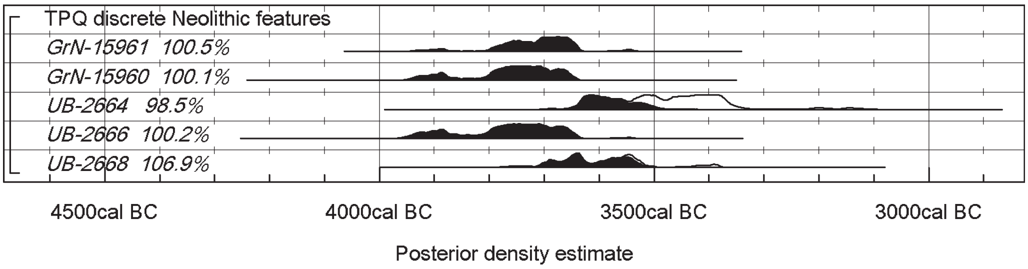

Fig. 12.8. Donegore Hill. Probability distributions of dates from discrete interior features. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.5, and its other components in Figs 12.6–7 and 12.9.

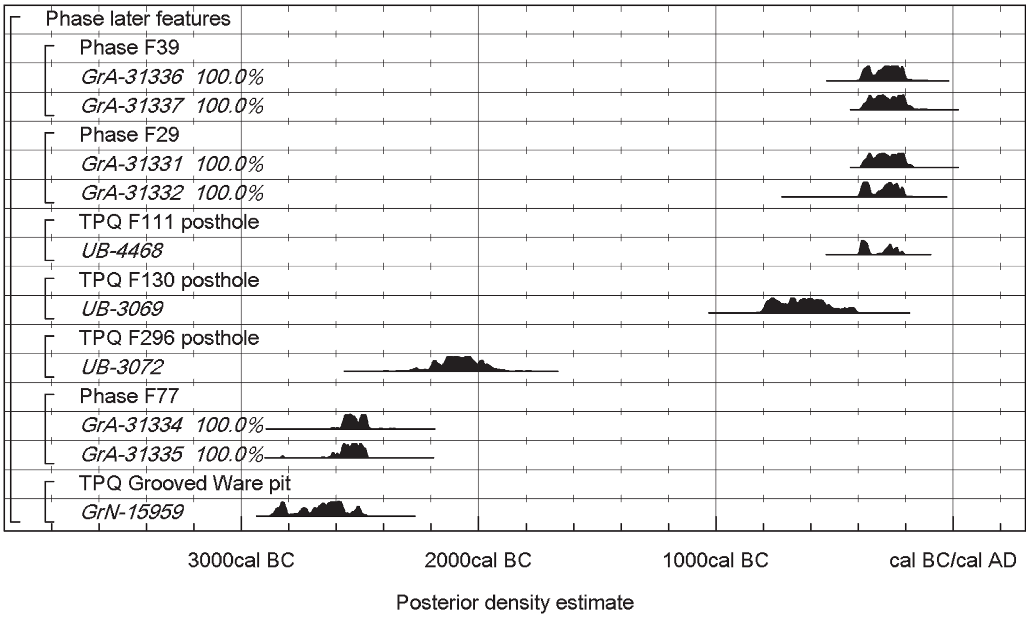

Fig. 12.9. Donegore Hill. Probability distributions of dates from later features. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.5, and its other components in Figs 12.6–8.

The inner palisade. In sector E5, palisade trench F263 provided two statistically consistent measurements (Fig. 12.6: *GrA-31320–1*; T'=0.0; T'(5%)=3.8; ν=1). A measurement on an unidentified bulk charcoal sample from the same context (Fig. 12.6: *GrN-15962*) is inconsistent with these (T'=14.8; T'(5%)=6.0; ν=2), and is treated as a *terminus post quem* for the feature. In sector E6, where no ditch accompanied the palisade, F22 provided two further short-life samples (Fig. 12.6: *GrA-31325–6*), results from which are statistically consistent with each other (T'=0.4; T'(5%)=3.8; ν=1) and with those for the short-life samples from F263 (T'=0.4; T'(5%)=7.8; ν=3). In sector E1, an unidentified bulk charcoal sample from F242, the outer of two converging palisade slots, provided a date in the late sixth to early fifth millennium cal BC (Table 12.1: UB-3070). This is excluded from the model on the grounds that the sample must have included already old charcoal, although a preliminary account of the lithics gives no indication that Mesolithic artefacts were present (Nelis 2003). Twenty-five metres to the north, an unidentified bulk charcoal sample from F423, the only palisade slot in Trench 86 in the same sector, provided a date in the second half of the fourth millennium cal BC (Fig. 12.6: UB-3073). This is statistically inconsistent with, and more recent than, all four dates on short-life samples from the inner palisade (T'=15.0; T'(5%)=9.5; ν=4). F423 was extremely shallow (Mallory *et al*. forthcoming, fig. 3.7). Given this and the statistical inconsistency with the short-life material, there must be some possibility that this sample contained later, intrusive, material. For this reason, it has been excluded from the model.

On this basis, the date of the inner palisade can be estimated as *3600–3515 cal BC* (*95% probability*; Fig. 12.6: *build inner palisade*), probably *3565–3520 cal BC* (*68% probability*).

The outer ditch. This provided no new samples. The existing measurements on bulk charcoal samples are all treated as *termini post quos*. In sector E3, *UB-3068* (Fig. 12.7) was measured on a sample from F51 on the base of the ditch in Trench 61. UB-2667 (Fig. 12.7), from Trench 24 in the same sector, is excluded from the model because it probably came from a late Neolithic recut, as discussed above. From a contiguous cutting, UB-3446 (Fig. 12.7) also seems to derive from a later recut. This sample has been excluded from the model since it appears to relate to a later third millennium cal BC phase of activity on the site rather

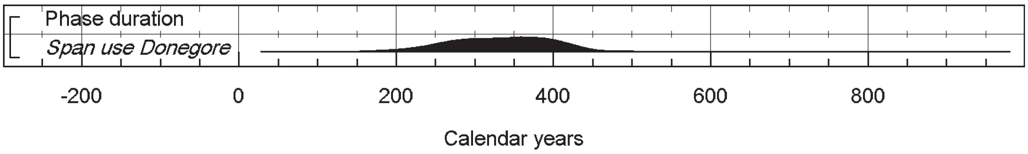

Fig. 12.10. Donegore Hill. Probability distribution of the number of years during which the enclosure was in primary use, derived from the model shown in Figs 12.5–9.

than the main Neolithic use. If it is included, the model has poor overall agreement ($A_{overall}$=55.6%). *UB-3448*, from the charcoal lens F301 in sector E5, and *UB-3447*, from the silt and charcoal layer F280 in sector E1, provide further measurements from the upper levels (Fig. 12.7).

These results do not provide a robust estimate for the date when the outer ditch was constructed. *UB-3068* (Fig. 12.7) provides a *terminus post quem* of *3960–3760 cal BC* (*94% probability*) or *3725–3710 cal BC* (*1% probability*), probably *3960–3855 cal BC* (*49% probability*) or *3845–3830 cal BC* (*5% probability*) or *3825–3790 cal BC* (*14% probability*), although the actual ditch construction could be several centuries later than this.

The outer palisade. This remains dated only by the *terminus post quem* provided by *UB-3071* (*95% probability*; *3980–3760 cal BC*; probably *3955–3905 cal BC*, *24% probability* or *3880–3800 cal BC*, *44% probability*; Fig. 12.7), although again the actual construction of the palisade may be some centuries later than this.

Five samples of unidentified bulk charcoal provide *termini post quos* for features in the interior of the enclosure (four pits and an occupation spread; Fig. 12.8; Table 12.1). All these features appear to belong to the fourth millennium cal BC use of the site.

Overall, the model defined in Figs 12.5–9 suggests that the early Neolithic activity on Donegore Hill began in *3855–3665 cal BC* (*95% probability*; Fig. 12.5: *start Donegore*), probably in *3780–3685 cal BC* (*68% probability*). This primary activity ended in *3590–3430 cal BC* (*95% probability*; Fig. 12.5: *end Donegore*), probably in *3545–3485 cal BC* (*68% probability*). Early Neolithic activity on the hill spanned a period of *200–455 years* (*95% probability*; Fig. 12.10: *use Donegore*), probably *270–410 years* (*68% probability*).

Some later activity has been dated on the hill (Fig. 12.9). There may be two discrete episodes of later activity. The first fell in the middle centuries of the third millennium cal BC, perhaps associated with Grooved Ware (GrN-15959, from F56, a pit in the interior) and with recutting of parts of the enclosure ditches (F77, in the inner ditch; and F34, Fig. 12.7, in the outer ditch). A second episode of activity took place in the third quarter of the first millennium cal BC (here dated by GrA-31331–2, from F29 and GrA-31336–7, from F39 (3), both pits cut into the silted up inner ditch, and by UB-4468 and UB-3069, bulk samples of unidentified charcoal from postholes providing *termini post quos* for this activity: Fig. 12.9).

Implications for the site

In the area of roughly 30 km by 30 km around Donegore Hill – between Lough Neagh to the west and Larne on the Irish Sea coast to the east, and from the Glencloy River to the north and the Lagan River to the south – eleven houses of the early Neolithic rectangular tradition have been discovered. These are at Ballygalley (*c.* 4; D. Simpson 1993; 1996; John Ó Néill, pers. comm.), Ballyharry (2; Moore 2003), Ballyharry Farm (1; Ó Néill *et al.* 2004), Mullaghbuoy (1; McManus 2004), Broughshane (1; Paul Logue, pers. comm.), Ballymacoss (1; Warren Bailie, pers. comm.) and Aghalislane (1; Ruairí Ó Baoill, pers. comm.). The dated examples are discussed below. While the scale of and evidence from the timber houses suggest the activities of individual family groups, Mallory, in pointing out that construction of the ditches at Donegore would have required about 18,000 labour hours, has proposed a workforce for the enclosure composed of several such family groups (Mallory and McNeill 1991, 78). The sheer quantity of material from the Donegore excavation also suggests the activities of a considerable number of people. For example, whether the partially excavated enclosure was permanently settled or only occasionally used and occupied on a periodic basis, it should be noted that it has produced an artefact assemblage that is vastly different to the size of the average assemblage from early Neolithic houses.

On the evidence of antiquarian collections, especially that of W. J. Knowles, large early Neolithic assemblages seem to have been present in some parts of the Antrim plateau to the north and in the valleys of the rivers that flow east from the plateau watershed through the Antrim Glens into the Irish Sea and those flowing west from it to form tributaries of the Bann. The floor of the Bann valley itself has also produced Neolithic material but there is a particularly Mesolithic character to the collections from there (Woodman *et al.* 2006, 297–304). It seems likely that people living in these areas, those using the Donegore enclosure and those using the houses were connected through social ties, reflected in the archaeological record as distribution or exchange networks, which also extended across the Irish Sea to south-west Scotland (Cooney 2000a, 227). County Antrim has yielded numerous caches of flint artefacts, especially scrapers (Woodman *et al.* 2006, 201–42) and has the highest numbers of flint and stone axeheads in the island (Cooney and Mandal 1998, figs 3.3, 4.29). Some of the coastal house sites, such as Ballygalley (Simpson 1995) and Ballyharry (Moore 2003), have yielded substantial lithic assemblages of both imported and locally sourced artefacts. Derek Simpson (1996, 132), referring

particularly to the presence of pitchstone from Arran, suggested that Ballygalley played a role in the circulation of lithics along the coast and across the Irish Sea. Donegore may have had a role in the movement of materials from the Antrim coast inland along river routes such as the Six Mile Water into the Lough Neagh basin.

In terms of sites that may have had a similar role to Donegore, on Lyles Hill, on the opposite side of the Six Mile Water valley and 7 km south-east from Donegore Hill, there is another well known hill top enclosed Neolithic site. However, as discussed in detail below, the palisades there may be no earlier than the third millennium cal BC and the embanked enclosure (E. Evans 1953) may be of second millennium cal BC date. While the date of the cairn within the enclosure is unclear, Alison Sheridan (2006a) has argued that it is one of a number of examples of a non-megalithic early Neolithic funerary tradition (see also discussion in Nelis 2004, 164). The Lyles Hill lithic assemblage has characteristics that indicate activity both in the early and middle Neolithic (Nelis 2004, 158, 164). There were differences between Lyles Hill and Donegore Hill in the amounts and types of tools produced, some of which may reflect the greater extent of later activity at Lyles Hill. Modified tools counted for 11% of the Lyles Hill assemblage but just 1% of the Donegore material. A greater proportion of hollow scrapers (which appear to develop at some point in the early Neolithic and to be dominant in middle Neolithic assemblages) were recovered at Lyles Hill than at Donegore Hill: 20 in *c.* 5500 pieces, compared with 1 in *c.* 25,000 (Nelis 2003, 216). Much effort appears to have gone into the production of projectiles and knives at Donegore Hill (Nelis 2003, 216). At Lyles Hill it is projectiles and hollow scrapers that stand out in the assemblage. The two enclosures are roughly equidistant from a small Cretaceous flint outcrop at Templepatrick in the Six Mile Water valley (Paul Logue, pers. comm.).

At Squires Hill, a hilltop site 7 km south-east of Lyles Hill and Donegore Hill (E. Evans 1938), a very large Neolithic biface and arrowhead assemblage was recovered, but only one finished arrowhead. Technologically, the assemblages from all these three sites were similar (Nelis 2004, 158) but at Donegore, Lyles Hill, and at the coastal promontory flint extraction and occupation site at Ballygalley Hill (A. Collins 1978), smaller leaf-shaped bifaces were dominant.

The Donegore enclosure thus can be set in local and regional contexts with considerable early Neolithic evidence. Whatever doubt there may be about the dating of the enclosing elements at Lyles Hill, it seems likely that particular hilltops were chosen as the focus of communal activity.

12.2 Magheraboy, Magheraboy townland, Co. Sligo, Irish grid reference 168690 335180

Location and topography

The Magheraboy enclosure is on the Cúil Irra peninsula, between Ballysadare Bay and Sligo Harbour. It is located 2 km north-east of the Carrowmore passage tomb cemetery, *c.* 50 m above sea level, off the summit of a domed south-west to north-east ridge (Figs 12.1 and 12.11). The highest point on the peninsula is Knocknarea at its western end, crowned by the passage tomb of Maeve's Cairn or Grave and smaller tombs. Carns Hill at the eastern end of the peninsula, with further passage tombs, is the next highest point (Bergh 1995; Cooney 2000a, with references). The Magheraboy ridge is intervisible with both these hills, as well as affording panoramic views of the surrounding countryside. The underlying geology is limestone, with overlying morainic deposits (Danaher 2004; Danaher and Cagney 2005; Danaher 2007, 91–3). Further indications of the complexity of the peninsula's prehistory are given by the recognition of a discontinuous stone-built bank, locally tripled, around the north and east of Knocknarea (Bergh 2000; 2002) and by discoveries in the Caltragh valley to the south of Magheraboy, including a possible megalithic tomb and an arc of stone wall built along the margin of marsh and drier ground, subsequently covered by peat and underlying two *fulachta fiadh*. The wall was formed of large upright stones with smaller stones packed between them and incorporated three stone axeheads (two of mudstone and one of gabbro) and two deposits of burnt animal bone. The wall, in which there was an entrance, continued beyond the excavated area, and it may have formed part of an enclosure or of a field system. The incorporated axeheads may indicate a Neolithic date or have been incorporated from nearby Neolithic occupation (Danaher 2007, 61–70).

Magheraboy is also near to other well known Neolithic sites and complexes (Fig. 12.1). To the west along the north Mayo coast there are areas of pre-peat field systems, notably at the Céide Fields (Caulfield 1983; Caulfield *et al.* 1998; Cooney 2000a, 25–9), about 50 km west of Magheraboy.

History of investigation

The Magheraboy enclosure was excavated in 2003 in advance of the construction of a new relief road running south from Sligo town (Danaher 2004; Danaher and Cagney 2005; Danaher 2007). Known archaeology in the immediate vicinity included a ringfort, and test excavation of this revealed a palisade trench cut by the ringfort ditch and running inside two segments of discontinuous ditch. More extensive topsoil stripping along the ridge revealed further stretches of palisade and further ditch segments. Excavation was widened within the area of the road-take. Over 1 ha of the eastern portion of the site was excavated. This showed an incomplete circuit, of irregular shape, possibly open on the east side, with a maximum dimension of 150 m and an estimated total area of 2.02 ha (Figs 12.11–12). The single segmented ditch circuit was generally accompanied by an internal palisade; but no ditch was seen at the north of the site in the north-west part of zone 2 where the palisade went on as a near-continuous line, nor in zone 4 to the east, where the palisade was formed of staggered, unconnected, short stretches. A possible entrance was marked by two opposed

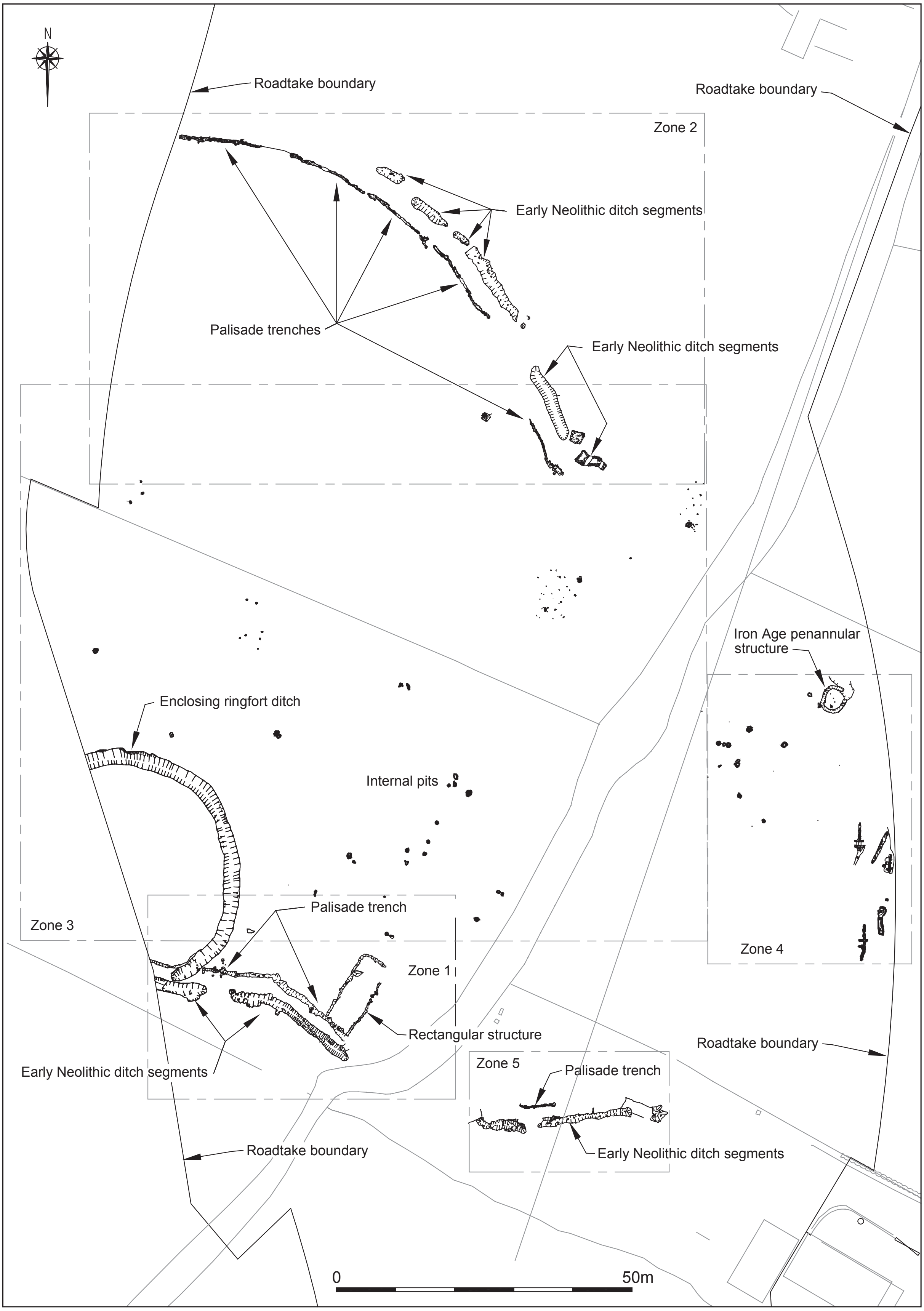

Fig. 12.11. Magheraboy. Plan showing Neolithic features; the later ring fort; and the extent of the landtake. After Danaher and Cagney 2005. © Archaeological Consultancy Services Ltd.

Fig. 12.12. Magheraboy. The ditch under excavation in zone 2 (location shown in Fig. 12.11). © Archaeological Consultancy Services Ltd.

inturned segment butts in the north-east, and there was a concave stretch in the south, where a 14 m-long rectangular timber structure was built at right-angles to and continuous with the palisade on its inner side. This structure survived as shallow, stone-packed slots, with no indication of any load-bearing posts, and is thus likely to have been open rather than roofed (Danaher 2007, 104–6).

Ditch segments varied in size, from over 20 m long, over 1.5 m wide and 0.7 m deep, with U-profiles and flat bases, to what were little more than shallow, elongated pits (Fig. 12.13). Carinated Bowl sherds and a small number of lithics were recovered from the ditch fills. These included three axeheads. One made from mudstone was found in segment 1 in zone 5, surrounded by some 30 quartz crystals. The butt of a porcellanite (Group IX) axehead that appeared to have been deliberately broken before deposition (Mandal 2007) was found with pottery and other lithics on the base of the ditch towards the north-west terminal of segment 3 in zone 2. There was also the butt of a limestone axehead in the same context. Farther to the south-east, on the base of the segment were fragments of a charred oak plank or planks. The segment was then backfilled but later recut, the recut avoiding the earlier placed deposit. Further deposition took place, with subsequent backfilling.

Much of the palisade was built in short stretches and was formed by post-pits and split timber planks, with stone packing (and early Neolithic Carinated Bowl sherds). In zone 5 at the south-east end of the site, the palisade was formed by close-set postholes, *c.* 0.25 m wide and deep.

Fifty-five pits were identified in the interior of the enclosure, along with some postholes. The majority of pits were small, from 0.4 to 0.9 m in diameter, and mainly only 0.2 m deep. These contained early Neolithic material, including deliberately broken sherds of pottery, some leaf-shaped arrowheads, scrapers and blades, lumps of fired clay, scraps of burnt bone and carbonised cereals (Danaher 2004; Danaher and Cagney 2005; Danaher 2007).

The artefact assemblage of 303 struck lithics (mainly chert) and 1229 Neolithic sherds, representing at least 36 vessels, from this extensively excavated site contrasts, as Danaher points out (2007, 117), with that of 23,849 struck lithics (mainly flint) and *c.* 45,000 Neolithic sherds from Donegore, which is of comparable size but of which only some 3% was excavated. The ratios of sherds to struck lithics are also different: 4:1 and 2:1 respectively. Several factors may contribute to this, not least the abundance of flint in Antrim, the fact that almost all of the Donegore assemblage came from topsoil and disturbed contexts (Nelis 2003, 208), while topsoil was removed by machine at Magheraboy, and the fact that later lithics were present at Donegore. Nonetheless, some of these differences could derive from distinct uses of the two enclosures.

Previous dating

Sixteen radiocarbon results were available from Neolithic contexts at Magheraboy before the start of this project. All samples were dated by Beta Analytic Inc according to

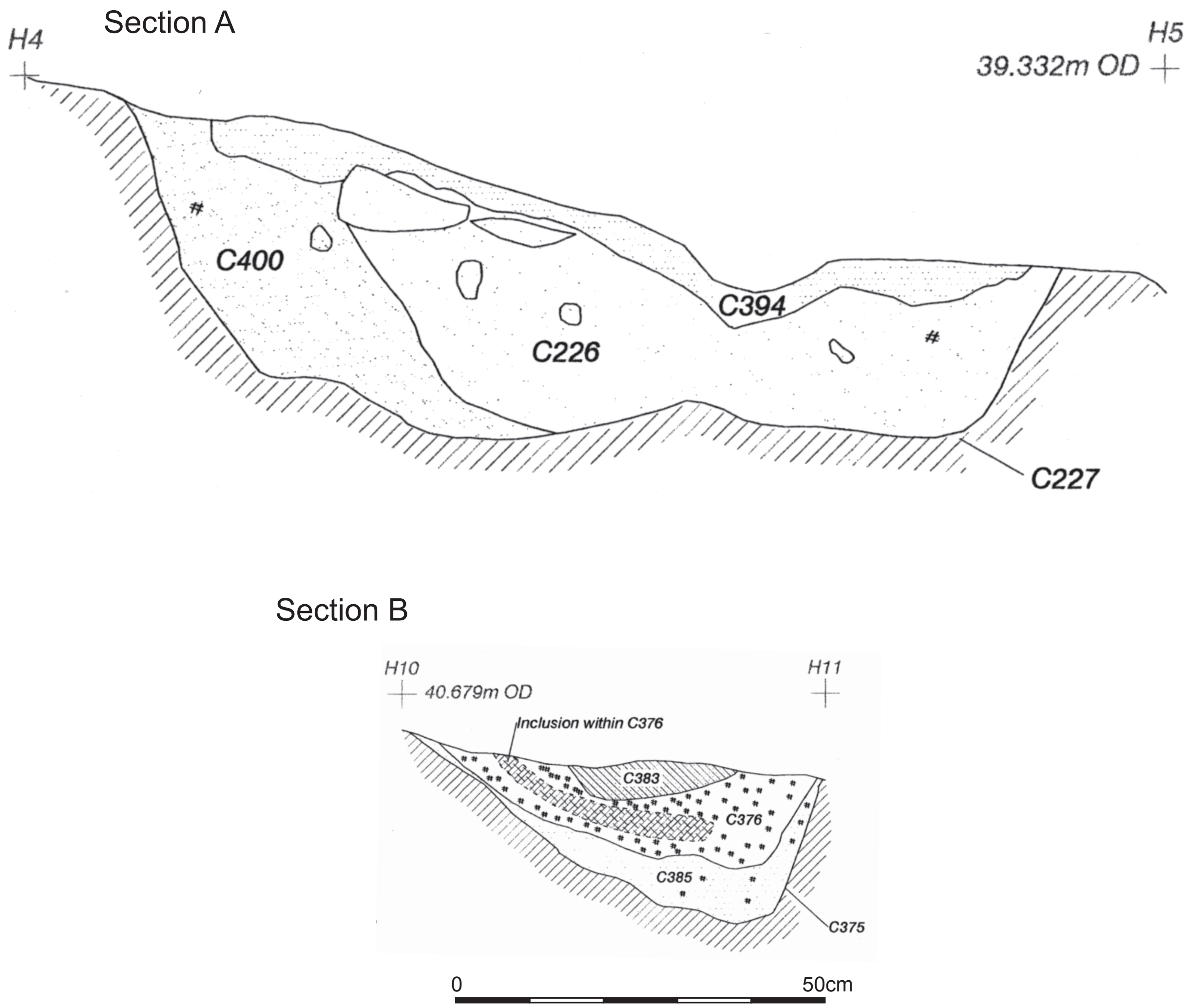

Fig. 12.13. Magheraboy. Sections of zone 2 segment 6 and zone 5 segment 2 (locations shown in Fig. 12.11). After Danaher and Cagney 2005. © Archaeological Consultancy Services Ltd.

methods outlined at http://radiocarbon.com/analytic.htm. Ten samples were measured by AMS and are denoted by an asterisk in Table 12.2; the other six samples were dated by LSC (Chapter 2.4).

A chronological model integrating the stratigraphic information from the site with these radiocarbon results is shown in Fig. 12.14. Three sequences are available from the enclosure ditch. In zone 2, segment 3 a sample of oak charcoal was dated from a plank lying on the base of the ditch (Fig. 12.14: *Beta-186488*). Because of the potential for an age offset in this sample it has been treated as a *terminus post quem* for its context. An AMS measurement on mixed short-life species of charcoal came from a stratigraphically later context also close to the base of the ditch (*Beta-199989*). In zone 5, segment 1, several fragments of *Corylus avellana* were dated from a context on the base of the segment (*Beta-199986*). This short-life sample was stratigraphically earlier than a bulk sample of *Corylus avellana* dated from the main fill of the segment (*Beta-199988*). In zone 5, segment 2, *Beta-199987*, an AMS determination on more than one fragment of *Corylus* charcoal came from a tip of charred material lying directly on the bottom of the ditch and occupying the entire depth of the ditch butt. Probably later than this is *Beta-199985*, from a middle fill further along the segment. This was overlain by *Beta-199984*, an AMS measurement on short-life charcoal. This evidence suggests that the enclosure ditch was constructed in *4050–3925 cal BC* (*95% probability*; Fig. 12.14: *build Magheraboy enclosure*), probably in *4040–4015 cal BC* (*30% probability*) or *3995–3960 cal BC* (*38% probability*).

Nine more dates were obtained from discrete features within the enclosure. These may provide an indication for the period in which the enclosure was in use (Fig. 12.14). There were a further six dates from later features (Table 12.2).

Objectives of the dating programme

The project aimed to refine the dating of the enclosure ditch and to confirm the early construction date suggested by the previous dating programme.

Table 12.2. Radiocarbon dates from Magheraboy, Co. Sligo. Posterior density estimates derive from the model defined in Figs 12.15.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Enclosure ditch								
OxA-16037	03E538F226S135/C	Single fragment *Corylus avellana* charcoal	Zone 2 segment 6. Context 226. Lower fill of F227, below 394, sometimes on base, sometimes above 400 (Danaher and Cagney 2005, figs 12, 20)	5014±37	−24.9		3950–3700	*3945–3705*
GrA-31959	03E538F226S135/A	Single fragment Pomoideae charcoal	From the same context as OxA-16037	4915±40	−25.4		3780–3630	*3775–3640*
Beta-199989*	03E538C169S159	Pomoideae and *Corylus* sp. charcoal	Zone 2 segment 3. Context 169. On base of NW butt of segment F82, over 203 at its SE end (Danaher and Cagney 2005, fig. 21)	5090±40	−25.9		3975–3785	*3920–3765*
Beta-186488	03E538F203S119	*Quercus* sp. charcoal, from the same plank as GrA-319161, OxA-X-2173-16	Zone 2 segment 3. Context 203. One of two fragments of charred plank on base of SE of segment F82, there underlying 169 (Danaher and Cagney 2005, fig. 21)	5060±70	−26.0	5085±35 T'=0.0; T'(5%)=3.8; ν=1	3970–3780	*3990–3800*
GrA-31961	Context 290/A	Single fragment *Quercus* sp. sapwood charcoal. Replicate of OxA-X-2173-16	Zone 2 segment 3. Context 290. From one of two fragments of charred plank on base of F82 (Danaher and Cagney 2005, fig. 21)	5085±40	−24.8			*3965–3810*
OxA-X-2173-16	Context 290/B	Single fragment *Quercus* sp. sapwood charcoal. Replicate of GrA-319161	From the same plank fragment as GrA–319161	5270±40	−25.1		4240–3970	
Beta-199986*	03E538C371S195	>1 fragment *Corylus avellana* charcoal	Zone 5 segment 1. Context 371. Within context 370 on base of segment F320, under 321 (Danaher and Cagney 2005, fig. 55)	5030±40	−25.5		3955–3705	*3955–3760*
Beta-199988	03E538C321S176	Bulk sample of *Corylus avellana* charcoal	Zone 5 segment 1. Context 321. Main fill of segment F320, overlying 370 (Danaher and Cagney 2005, figs 54, 55)	5080±90	−26.1		4045–3655	*3910–3655*
Beta-199987*	03E538C323S203	*Corylus* sp. charcoal, probably >1 fragment	Zone 5 segment 2. Context 323. Fill of W butt of segment F322. ?tipped in, lying directly on bottom and occupying entire depth of butt (Danaher and Cagney 2005, figs 54, 56)	5150±40	−26.2		4040–3805	*4045–3925* (*73%*) or *3880–3815* (*22%*)
GrA-31960	03E538C376S226/C	Single fragment *Corylus avellana* charcoal	Zone 5 segment 2. Context 376. A middle fill of segment F375, with oxidised clay and many charcoal flecks. Dump? Below 383 and above 385 (Danaher and Cagney 2005, figs 54, 56)	4860±40	−25.5		3710–3530	*3715–3625* (*82%*) or *3590–3530* (*13%*)
OxA-16021	03E538C376S226/D	Single fragment *Corylus avellana* charcoal	Zone 5 segment 2. Context 376. A middle fill of segment F375, with oxidised clay and many charcoal flecks. Dump? Below 383 and above 385 (Danaher and Cagney 2005, figs 54, 56)	4870±37	−25.4		3710–3540	*3715–3630* (*91%*) or *3565–3535* (*4%*)
Beta-199985*	03E538C382S231	>1 fragment *Corylus avellana* charcoal	Zone 5 segment 2. Context 382. A middle fill of segment F375, beneath 378 and above 418 (Danaher and Cagney 2005, figs 54, 56)	5230±60	−25.0		4235–3950	*4030–3925* (*48%*) or *3880–3795* (*47%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Beta-199984*	03E538C425S236	*Corylus avellana*, charcoal, probably >1 fragment	Zone 5 segment 2. Context 425. Fill of recut in top of segment F375 (Danaher and Cagney 2005, fig. 56)	5160±60	−25.7		4055–3795	*4225–4205* (*1%*) or *4165–4130* (*3%*) or *4075–3790* (*91%*)
Discrete Neolithic features								
Beta-197649*	03E0536F3S5	>1 fragment charred hazelnut shell	F3. Pit containing Carinated Bowl pottery (O'Neil 2005a, figs 4, 7; pl. 15)	4910±40	−22.3		3780–3630	*3775–3635*
Beta-197653*	03E0536F69S36	> 1 fragment *Corylus* sp. charcoal	F69. Stray charcoal in postpit of one posthole among several forming an arc within the ringfort, inside the causewayed enclosure (O'Neil 2005a, figs 3, 7). Sub-circular, 0.56 m x 0.40 m, 0.13 m deep, probably truncated. Contained fragment of rock crystal	4790±40	−25.2		3650–3380	*3650–3520*
Beta-186486	03E538F126S90	Bulk sample of *Quercus* sp. charcoal	Context 126. Fill of pit F125 within enclosure, containing Neolithic Bowl pottery	5150±110	−25.0		4240–3700	*4240–3705*
Beta-186487	03E538F148S92	Bulk sample of *Quercus* sp. charcoal	Context 148. 1 of 3 fills of pit F147 within enclosure, containing Neolithic Bowl pottery	4880±70	−26.3		3800–3520	*3895–3880* (*1%*) or *3800–3520* (*94%*)
Beta-196298*	03E538C230S123	>1 grain charred hexaploid wheat	Context 230. Fill of pit F221	4660±40	−24.1		3630–3350	*3635–3575* (*42%*) or *3535–3415* (*53%*)
Beta-196299*	03E538C249S138	>1 fragment charred hazelnut shell	Context 249. Fill of pit F248. Much root disturbance	4670±40	−23.8		3630–3350	*3635–3555* (*46%*) or *3535–3415* (*49%*)
Beta-199990	03E538C93S38	>1 fragment *Corylus avellana* charcoal	Context 93. Fill of pit F93	5080±70	−24.9		4040–3700	*3975–3705*
Beta-186483	03E538F29S23	Bulk sample of *Alnus glutinosa* charcoal	Context 29. Fill of pit F28 within enclosure, containing Neolithic Bowl pottery	5130±100	−25.6		4230–3700	*4035–3700*
Beta-186484*	03E538F41S17	> 1 fragment *Corylus* sp. charcoal	Context 41. Base of pit F40 within enclosure, containing Neolithic Bowl pottery and some lithics	4770±50	−25.2		3650–3370	*3660–3495*
Later contexts								
Beta-197650	03E0536F10S1	Barley grains	F10. Pit within ringfort	1170±40	−24.4		cal AD 720–980	
Beta-197651	03E0536F12S3	Barley grains	F12. Spread within ringfort	1240±40	−23.9		cal AD 660–890	
Beta-197655	03E0536F121S34	*Corylus* sp./*Alnus* sp. charcoal	F16. Pit within ringfort	830±60	−26.0		cal AD 1030–1290	
Beta-197654	03E0536F75S29	*Fraxinus* sp. charcoal	F75. A fill of section D of ringfort	1340±80	−24.4		cal AD 560–890	
Beta-197652	03E0536F57S32	*Corylus* sp. charcoal	F57. Spread of burnt material overlying hearth within ringfort	1150±70	−26.6		cal AD 680–1030	
Beta-186485	03E538F72S97	Charred split *Quercus* sp. plank	F72. Charred plank from foundation trench of small, circular structure. No sign of burning *in situ*	2140±60	−26.2		390–40	

* AMS date measured by Beta Analytic Inc.

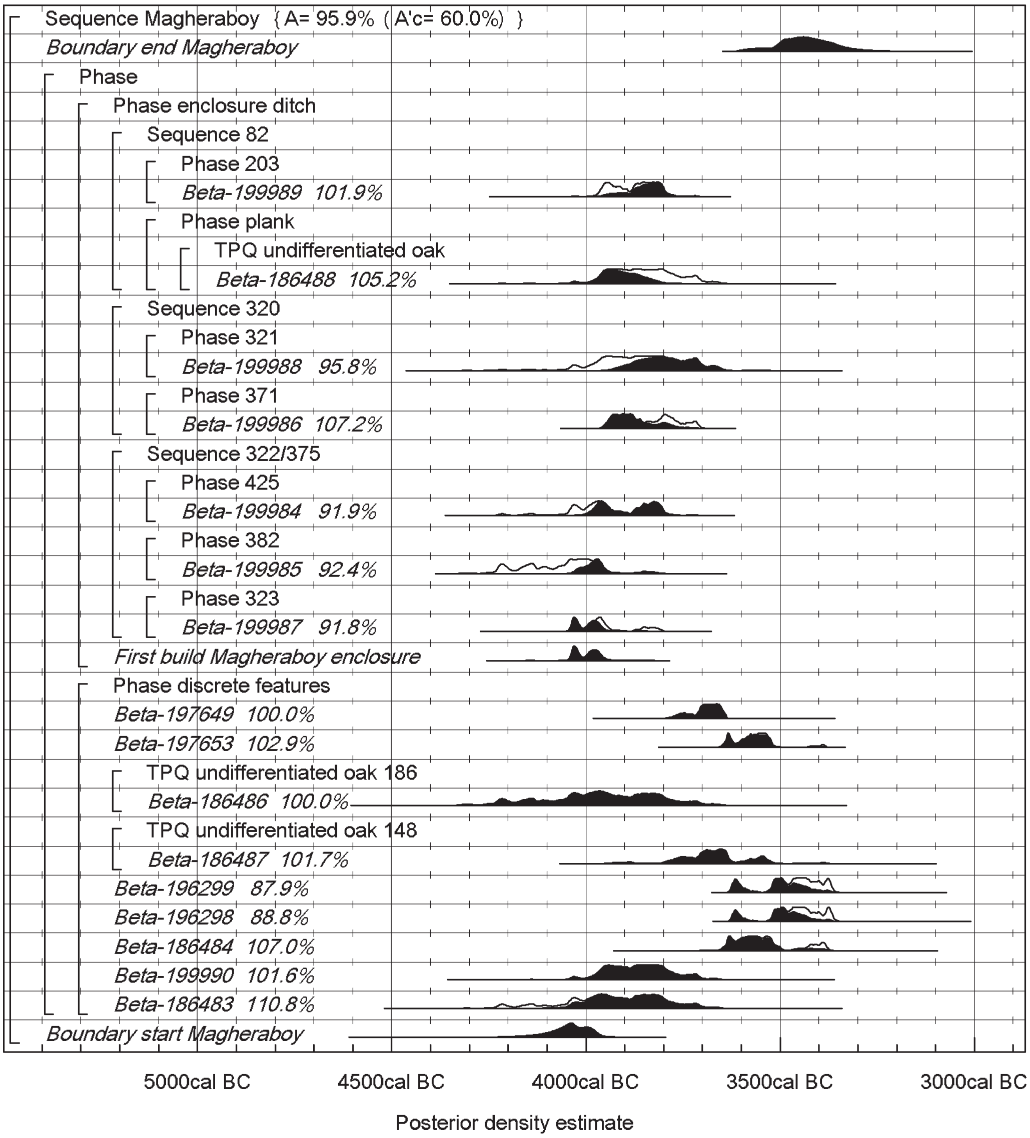

Fig. 12.14. Magheraboy. Probability distribution of dates from the enclosure available before 2004. The format is identical to that of Fig. 12.6. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Sampling

Six fragments of short-life charcoal were submitted for dating: two from zone 2, segment 6, from a lower fill on the base or near the base of the segment; two replicate measurements of sapwood from the oak plank from zone 2, segment 3, previously dated by Beta-186488; and two samples from context 376, a middle fill of zone 5, segment 2, which was dated to provide a longer sequence of samples in this segment. No samples were available at any stage from the palisade or the rectangular structure, probably reflecting the fact that neither had burnt down.

Results and calibration

Full details of all the radiocarbon determinations from the Neolithic contexts at Magheraboy are provided in Table 12.2.

Analysis and interpretation

A chronological model for the Neolithic enclosure at Magheraboy is shown in Fig. 12.15. The two replicate samples on sapwood charcoal from the plank from zone 2, segment 3, contexts 203 and 290 (GrA-31961, OxA-X-2173-16), are not statistically consistent with the original measurement (Fig. 12.15: *Beta-186488*; T'=12.4; T'(5%)=6.0; ν=2). OxA-X-2173-16, an experimental measurement on a target which produced only 457 μg, produced a result which was significantly earlier than the other two measurements. It appears that this sample contained sediment carbon in addition to the charcoal. This measurement is therefore regarded as providing an inaccurate date for the plank and has been excluded from the model. The other two determinations are statistically consistent (T'=0.0; T'(5%)=3.8; ν=1), although *Beta-186488* is still treated as a *terminus post quem* as it may

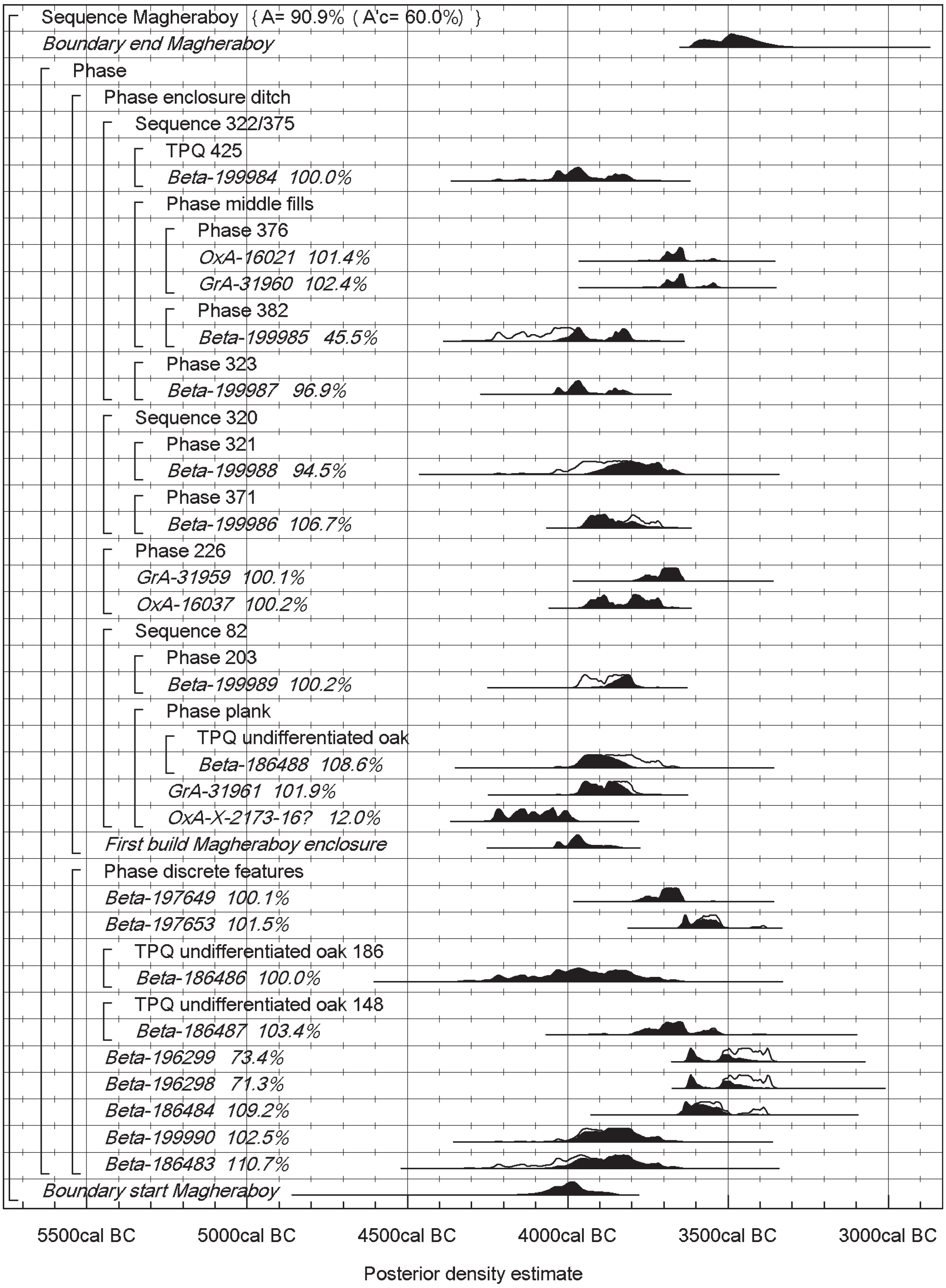

Fig. 12.15. Magheraboy. Probability distributions of dates from the enclosure. The format is identical to that of Fig. 12.6. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

have contained charcoal from the interior part of the dated tree. *Beta-199989* (Fig. 12.15), a mixed charcoal sample of short-lived species from a context overlying 203, produced a measurement which is in good agreement with this sequence.

The two samples from context 226 in zone 2 segment 6, provided determinations which are statistically consistent (Fig. 12.15: *OxA-16037, GrA-31959*; T'=3.3; T'(5%)=3.8; ν=1). These samples are rather later than those from some of the other dated segments and the section across the segment (Fig. 12.13: section A) may suggest that the ditch had been cleaned out, at least in this area. In zone 5 segment 1, short-lived samples were dated from context 371, a charcoal lens within context 370 which lay on the base of the ditch (Fig. 12.15: *Beta-199986*) and from the overlying layer, context 321 (Fig. 12.15: *Beta-199988*). The two measurements are in good agreement with this stratigraphic relationship.

In zone 5, segment 2, context 323, tipped into a segment butt on to the base of the ditch, provided a date on short-

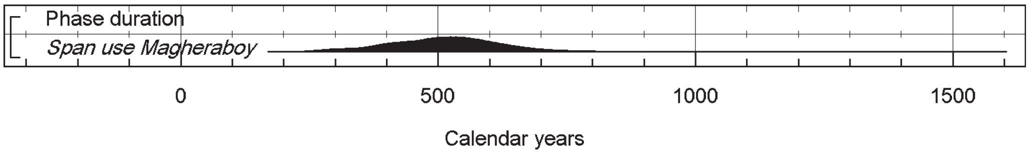

Fig. 12.16. Magheraboy. Probability distribution of the number of years during which the enclosure was in primary use, derived from the model shown in Fig. 12.15.

lived charcoal (Fig. 12.15: *Beta-199987*), and context 382, a middle fill of the same segment, provided another (Fig. 12.15: *Beta-199985*). Another middle fill, context 376 (Fig. 12.13: section B), provided two statistically consistent measurements on short-life samples (Fig. 12.15: *OxA-16021, GrA-31960*; T'=0.0; T'(5%)=3.8; ν=1). These measurements, however, are substantially later than *Beta-199984,* measured on more than one fragment of short-lived charcoal from a recut into the top of the same segment. It seems most likely that the sample for *Beta-199984* included already reworked charcoal, and so this date is modelled as a *terminus post quem* for its context; alternatively, context 376 may have been the fill of an otherwise unidentified recut.

Samples were also dated from eight pits and a posthole within the enclosure (Fig. 12.15), the posthole forming part of an arc. Of these, *Beta-186486* and *-186487* were of oak charcoal and may be rather older than the contexts from which they were recovered. All these features are treated as part of the phase of use of the enclosure.

The model shown in Fig. 12.15 suggests that the Neolithic enclosure at Magheraboy was constructed in *4040–3850 cal BC* (*95% probability*; Fig. 12.15: *build Magheraboy enclosure*), probably *4040–4015 cal BC* (*11% probability*) or *4000–3935 cal BC* (*57% probability*). Including the discrete features in the interior, overall activity at Magheraboy started in *4115–3850 cal BC* (*95% probability*; Fig. 12.15: *start Magheraboy*), probably in *4065–3945 cal BC* (*68% probability*). Neolithic activity continued until *3615–3355 cal BC* (*95% probability*; Fig. 12.15: *end Magheraboy*), probably until *3595–3545 cal BC* (*15% probability*) or *3520–3410 cal BC* (*53% probability*). The site was in use for *285–715 years* (*95% probability*; Fig. 12.16: *use Magheraboy*), probably for *405–620 years* (*68% probability*).

Sensitivity analysis: an alternative model

An alternative model for the chronology of the enclosure at Magheraboy is shown in Fig. 12.17. In this reading, all bulk samples, whether measured by LSC or by AMS, and even if composed of short-life material, are interpreted as *termini post quos* for the contexts from which they were recovered. This accounts for the potential for such samples to include redeposited fragments of charred plant remains.

This model suggests that the enclosure at Magheraboy was constructed in *3965–3780 cal BC* (*95% probability*; Fig. 12.17: *build Magheraboy enclosure*), probably in *3910–3795 cal BC* (*68% probability*). If the discrete features within the enclosure are interpreted as part of the phase of its use, then activity on the site began in *4320–3775 cal BC* (*95% probability*; Fig. 12.17: *start Magheraboy*), probably in *4030–3815 cal BC* (*68% probability*). The primary Neolithic use of the site ended in *3610–3335 cal BC* (*95% probability*; Fig. 12.17: *end Magheraboy*), probably in *3520–3370 cal BC* (*68% probability*). In this case, we estimate that the site was in use for *220–895 years* (*95% probability*; Fig. 12.18: *use Magheraboy*), probably for *330–620 years*.

Key parameters from both models (Figs 12.15 and 12.17) are shown in Fig. 12.19. It is apparent that our estimates for the time when the enclosure went out of use are robust against our alternative interpretations. This is largely because in both readings all the radiocarbon dates provide *termini post quos* for the end of the primary Neolithic use of the site. In contrast, our estimates for the date when the enclosure was constructed and when early Neolithic activity on the site began are more variable. In the first model, this activity began in the 40th or 41st centuries cal BC, within a few generations of 4000 cal BC. The second model provides less precise estimates because it depends on fewer radiocarbon dates. In this case, activity probably began rather later, in the 39th or 40th centuries cal BC.

The first model is preferred for two reasons. First, it uses the same criteria by which to determine whether dates are dismissed as *termini post quos* as are employed elsewhere in this project, while the second model is based on different and more stringent ones. Secondly, in the absence of definitely Mesolithic lithics from the assemblage (Danaher and Cagney 2005, 234–5), it is difficult to invoke the extensive presence of earlier, redeposited charcoal, for example as the result of some kind of extensive land-use including clearance and burning by hunter-gatherers, to account for all the measurements on bulk short-life material.

Implications for the site

At Magheraboy, Carinated Bowl pottery occurs from the base of the ditch segments onwards. The ditch also contained a mudstone axehead, probably of local origin, in segment 1, zone 5, dated by *Beta-199986* to *3955–3760 cal BC* (*95% probability*; Fig. 12.15: *Beta-199986*), probably to *3945–3855 cal BC* (*64% probability*) or *3805–3790 cal BC* (*4% probability*). A porcellanite axehead broken by a series of controlled blows before deposition was recovered from the base of segment 3 in zone 2. This is best dated by sapwood from the burnt plank on the base of the ditch (presumably non-residual because of its integrity as a single piece), to

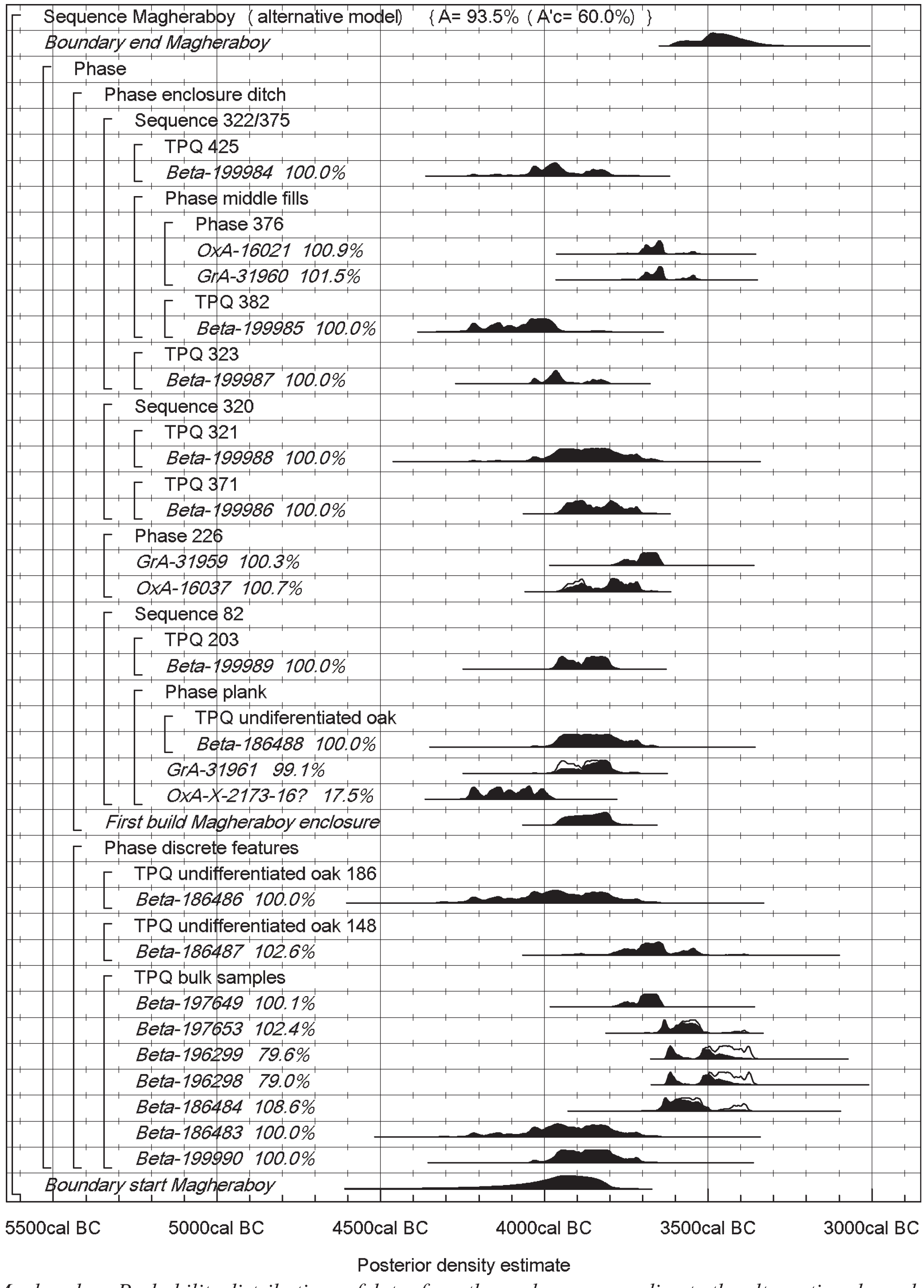

Fig. 12.17. Magheraboy. Probability distributions of dates from the enclosure according to the alternative chronological model. The format is identical to that of Fig. 12.6. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

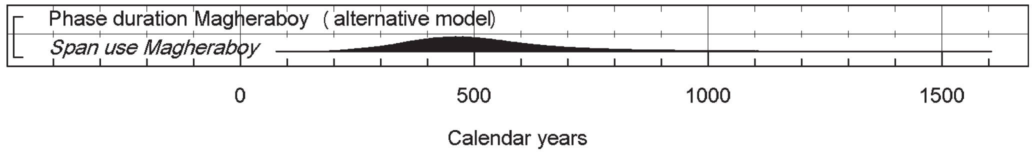

Fig. 12.18. Magheraboy. Probability distribution of the number of years during which the enclosure was in primary use, derived from the alternative model shown in Fig. 12.17.

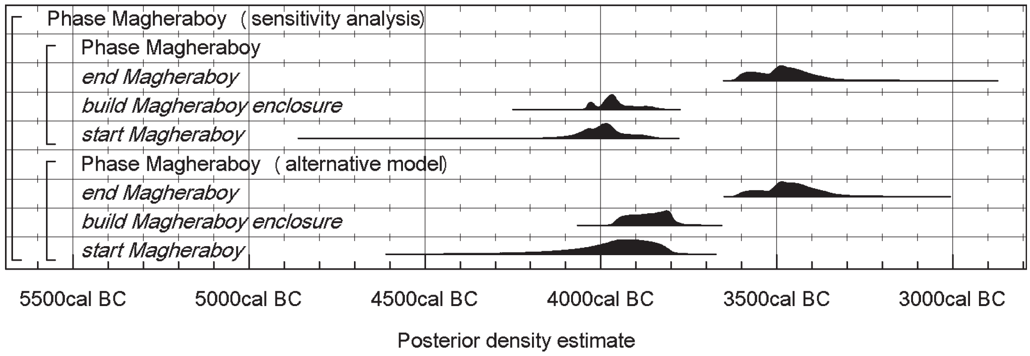

Fig. 12.19. Magheraboy. Key parameters from the chronological models defined in Figs 12.15 and 12.17.

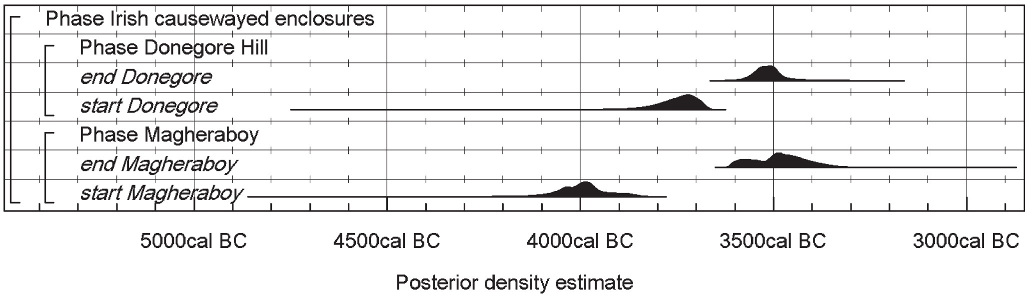

Fig. 12.20. Donegore Hill and Magheraboy. Probability distributions for the dates for construction and disuse, derived from the models defined in Figs 12.5–9 and 12.15.

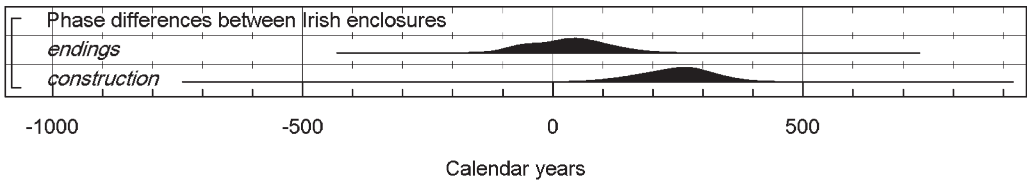

Fig. 12.21. Donegore Hill and Magheraboy. Differences between dates of construction and disuse for the causewayed enclosures at Donegore and Magheraboy, calculated from the distributions shown in Fig. 12.20.

3965–3810 cal BC (*95% probability*; Fig. 12.15: *GrA-31961*), probably to *3960–3905 cal BC* (*35% probability*) or *3880–3830 cal BC* (*33% probability*). This in turn appears to demonstrate that porcellanite was in circulation across the northern part of Ireland by the 40th or 39th centuries cal BC (see Sheridan *et al.* 1992; Cooney and Mandal 1998; Cooney 2000a). Hexaploid wheat was dated from pit F221 in the interior, although more than one grain was bulked together for AMS dating. This dates to *3635–3575 cal BC* (*42% probability*; Fig. 12.15: *Beta-196298*) or *3535–3415 cal BC* (*53% probability*), probably to *3630–3595 cal BC* (*34% probability*) or *3520–3480 cal BC* (*31% probability*) or *3475–3460 cal BC* (*3% probability*).

The undated palisade and rectangular timber structure could be earlier, contemporary with or, indeed, later than the ditch.

We will not go on in this instance to discuss the implications of these date estimates for our understanding of the local region around Magheraboy. At this point, given the early date of the site, that first requires the assessment of a very wide body of evidence for the rest of the early Neolithic in the area and in Ireland as a whole. This poses fundamental questions about the date of the start of the Neolithic in Ireland, and is a major challenge, raising several difficult, unresolved issues. We return to Magheraboy, however, at intervals and in the concluding discussion of this chapter.

Preliminary discussion of the two dated enclosures

The two causewayed enclosures dated in Ireland were built at very different times. Magheraboy began in *4115–3850 cal BC* (*95% probability*; Fig. 12.20: *start Magheraboy*), probably in *4065–3945 cal BC* (*68% probability*); see also the concluding section of the chapter (12.4) for a discussion of the issues raised by this date estimate. Donegore began in *3855–3665 cal BC* (*95% probability*; Fig. 12.20: *start Donegore*), probably in *3780–3685 cal BC* (*68% probability*). No short-life material has been dated from the base of the ditch circuits at Donegore, and so the actual date of construction could be slightly earlier than the estimates presented here. On the basis of the consistency of the dates from recuts F76 and F180 in the inner ditch (Fig. 12.6: *GrA-31339*, *-31341, -32322,* and

-31324), and the comparable *terminus post quem* provided by *UB*-3068 from the base of the outer ditch, however, it is improbable that Donegore is as early as Magheraboy, and it is perfectly possible that the estimates presented here are close to the actual age of the enclosure. The enclosures were constructed *70–405 years apart* (*95% probability*; Fig. 12.21: *construction*), probably *170–330 years apart* (*68% probability*). Activity still seems to have been continuing at Magheraboy at the time when Donegore was constructed, as both sites seem to have gone out of use within a relatively restricted span of time in the 36th or earlier 35th centuries cal BC (Fig. 12.21: *endings*; Fig. 12.20: *end Donegore* and *end Magheraboy*).

12.3 Donegore and Magheraboy in context: the early Neolithic and the start of the middle Neolithic in Ireland

In order to put our estimates for the dates of the enclosures at Donegore Hill and Magheraboy in context, we have to consider the chronology of other aspects of the early Neolithic in Ireland. Several alternative models are presented for the introduction of Neolithic practices into the island (Figs 12.53–7). These express different views of what defines the early Neolithic in Ireland and distinguishes it from the middle Neolithic. This is critical because, in order to provide a reliable estimate for the start of the Neolithic, it is necessary to impose a statistical distribution on the overall phase of activity sampled for radiocarbon dating, and so this has to be explicitly defined (see Chapter 2.4.1 and 2.8 for fuller discussion). In the analyses presented here we have used a uniform distribution as the uninformative prior information for our models (Buck *et al*. 1992; Bronk Ramsey 1995). This is required to counteract the statistical scatter on the radiocarbon dates (Steier and Rom 2000; Bronk Ramsey 2000; Chapter 2.2). If this scatter is not explicitly taken into account, such assemblages of dates can be erroneously interpreted as suggesting a start date for the activity in question which is anomalously early, an end date that is anomalously late and a duration that is anomalously long (Bayliss *et al*. 2007a). A uniform distribution has been chosen because this is comparatively uninformative, meaning that the results of the models change little if the dated activity was actually not distributed uniformly. Research is now underway which will allow other forms of distribution to be implemented for such analyses (Karlsberg 2006; Bronk Ramsey 2009). In due course, therefore, it will be possible to compare estimates from models with different forms of distribution to assess the sensitivity of results to this input. In this chapter, however, we will compare models which impose different archaeological definitions of the uniform phase. Differences between the results can therefore be used to assess how far the date estimates depend on the archaeological and scientific information put into the models, and how far on the statistical assumptions which underpin them.

All our models for the early Neolithic in Ireland exclude dates from causewayed enclosures, since the purpose of this analysis is to provide independent date estimates for comparison with the dated enclosures. The models include components relating to houses and other occupation evidence and forms of activity associated with diagnostically early Neolithic material. Dates from portal tombs and court tombs, and from two round mounds and Neolithic field systems, also form components of the models, although these are treated in different ways: either as by definition early Neolithic, or as potentially early and middle Neolithic in date. In either case, these sites must date to after the introduction of Neolithic practices into Ireland. In all models, dates made on samples of domesticated animals and plants must also post-date this boundary. Dates from Linkardstown burials and passage tombs, regarded here as elements of the middle Neolithic because of their different practices and associated material, have been included in the models as providing a *terminus ante quem* for the end of the early Neolithic phase of activity. The difficulties with the early Neolithic dating of passage tombs that has been proposed (e.g. Sheridan 2003a; 2003b; 2004; 2005) are discussed in the relevant section below. It should be stressed that no formal attempt has been made to model the chronology of the middle Neolithic as a whole.

It should also be noted that other radiocarbon dates which fall into the fourth millennium cal BC but which are not associated with diagnostically Neolithic activity have not been included in our preferred models: principally dates on trackways and unaccompanied burials. Dates for late Mesolithic contexts have not been systematically included. Radiocarbon dates falling in the fifth millennium cal BC and associated with diagnostically Mesolithic material are still, unfortunately, too few to enable a chronological model for the dating of the terminal Mesolithic in Ireland to be constructed which can bear comparison with our models for the introduction of Neolithic practices (see discussion in Woodman 2009; Bayliss and Woodman 2009). Some relevant dates, such as those from Ferriter's Cove (Woodman *et al.* 1999), are modelled and discussed as appropriate.

The components of the overall models for the chronology of the early Neolithic in Ireland are first discussed one by one. Individual models have been constructed to estimate independently the dating of different aspects of the early Neolithic on the island. So, for example, Figs 12.22–7 define a model for the chronology of early Neolithic houses. This enables us to compare the chronology of houses with that of enclosures. Neolithic houses are, however, associated with diagnostic early Neolithic material culture, as are other occupation and activity sites (such as for axehead production and burial; Fig. 12.30), portal tombs (Fig. 12.31) and court tombs (Figs 12.32–4). Consequently, if we wish to date the introduction of early Neolithic material into Ireland, then a model which includes the dates from all these sites is to be preferred (Figs 12.53–7). The component sections of the overall model, however, serve two purposes. First, they provide independent date

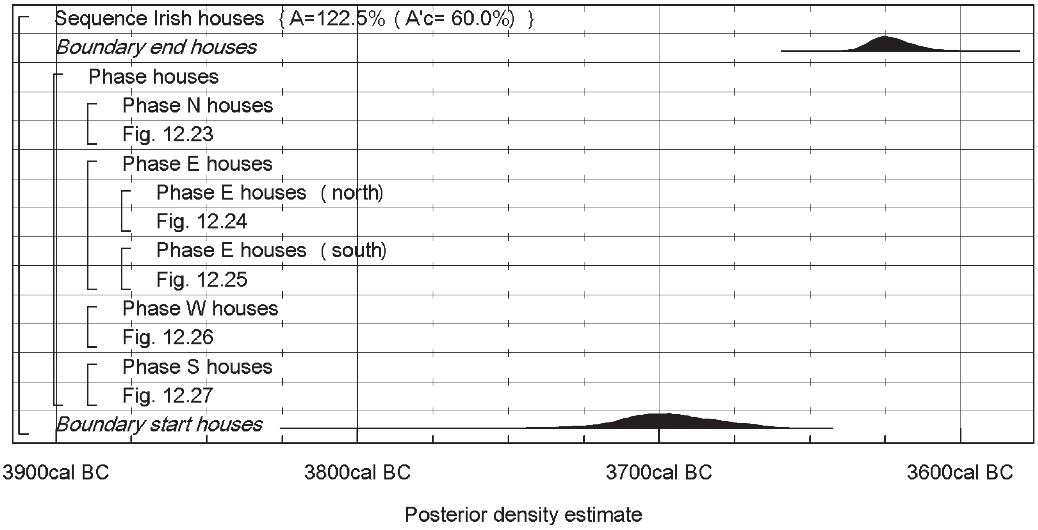

Fig. 12.22. Early Neolithic houses in Ireland. Overall structure of the chronological model. The component sections of this model are shown in detail in Figs 12.23–7. The large square brackets down the left-hand side of Figs 12.22–7, along with the OxCal keywords, define the overall model exactly.

estimates for particular aspects of the early Neolithic in Ireland. Secondly, comparison of their results allows us to assess the robustness of the overall model and to consider questions such as whether all these elements were introduced at the same time.

The assemblage of radiocarbon dates associated with Irish Neolithic material has a particularly high proportion of results from samples which consisted of bulked, unidentified, or mature charcoal, or were in uncertain relation to their contexts, or both (Woodman *et al*. 1999, 145–6; Woodman 2000, 225–9). This is partially a consequence of the poor survival of unburnt bone in many parts of the island, although too often even today samples of oak are submitted for dating without the isolation of sapwood (Ashmore 1999a; McSparron 2003). It is also a function of the accessibility of megalithic tombs over long periods and the timing of many excavations of tombs which took place in the early days of radiocarbon dating when large samples were necessary.

Houses

The boom in numbers of known Irish early Neolithic houses has already been discussed in detail elsewhere (Cooney 1999; Grogan 2004; Smyth 2006; 2007; McSparron 2008). Smyth (2011) notes some 80 structures from 49 sites and publication of discoveries has continued after the modelling for this project was carried out, for example the houses at Russellstown and Busherstown, Co. Carlow (O'Connell and O'Neill 2009). Dated early Neolithic houses are described here for the sake of presentation in five regional groupings: a northern group, with Enagh, Ballygalley, Ballyharry and Ballynagilly; an eastern (north) grouping, with Monanny, Newtown, and Knowth; an eastern (south) grouping, with Corbally, Kishoge and Kilgobbin; Ballyglass and Gortaroe in the west; and a southern group from Granny in the east to Cloghers in the west (Fig. 12.1). Full details of the dated samples and radiocarbon measurements are given in Table 12.3.

The overall form of the model for the chronology of early Neolithic houses in Ireland is given in Fig. 12.22, with the component sections relating to the northern group being given in Fig. 12.23, to the eastern (north) group in Fig. 12.24, to the eastern (south) group in Fig. 12.25, to the western group in Fig. 12.26, and to the southern group in Fig. 12.27.

In the northern group, a basically rectangular structure at Enagh, Co. Derry, was partially excavated in advance of housing development (McSparron 2003). This was some 6.2 by 4.3 m, defined by a foundation trench, two corner postholes and a central internal posthole. Only coarse pottery and a single flint blade were directly associated with the structure. Two radiocarbon determinations were obtained. A sample of unidentified charcoal from the wall slot (*Beta-152195*) produced a result which is statistically significantly earlier than that from hazelnut shells from posthole F207 of the same structure (Fig. 12.23: *Beta-188378*; T'=13.1; T'(5%)=3.8; ν=1).

Four structures were excavated at Ballygalley, Co. Antrim (D. Simpson 1996; John Ó Néill, pers. comm.), a site remarkable for the large-scale working of flint from the adjacent beach and from an extraction site on Ballygalley Hill (A. Collins 1978) as well as for the largest concentration in Ireland of imported Arran pitchstone (Ballin 2009). These, together with other non-local materials, including porcellanite (Group IX) and tuff (Group VI) axeheads, have led to the interpretation of the site as a redistribution centre for both local and imported materials (D. Simpson 1996, 132). In the north of the excavated area, on site 1, a large number of pits with some postholes, stakeholes and slot trenches were found, as well as House 1, a sub-rectangular structure 8 m by 4 m defined by beam slots (which contained large quantities of charred grain), and containing two parallel rows of three postholes, with a partly open 'annexe' at one

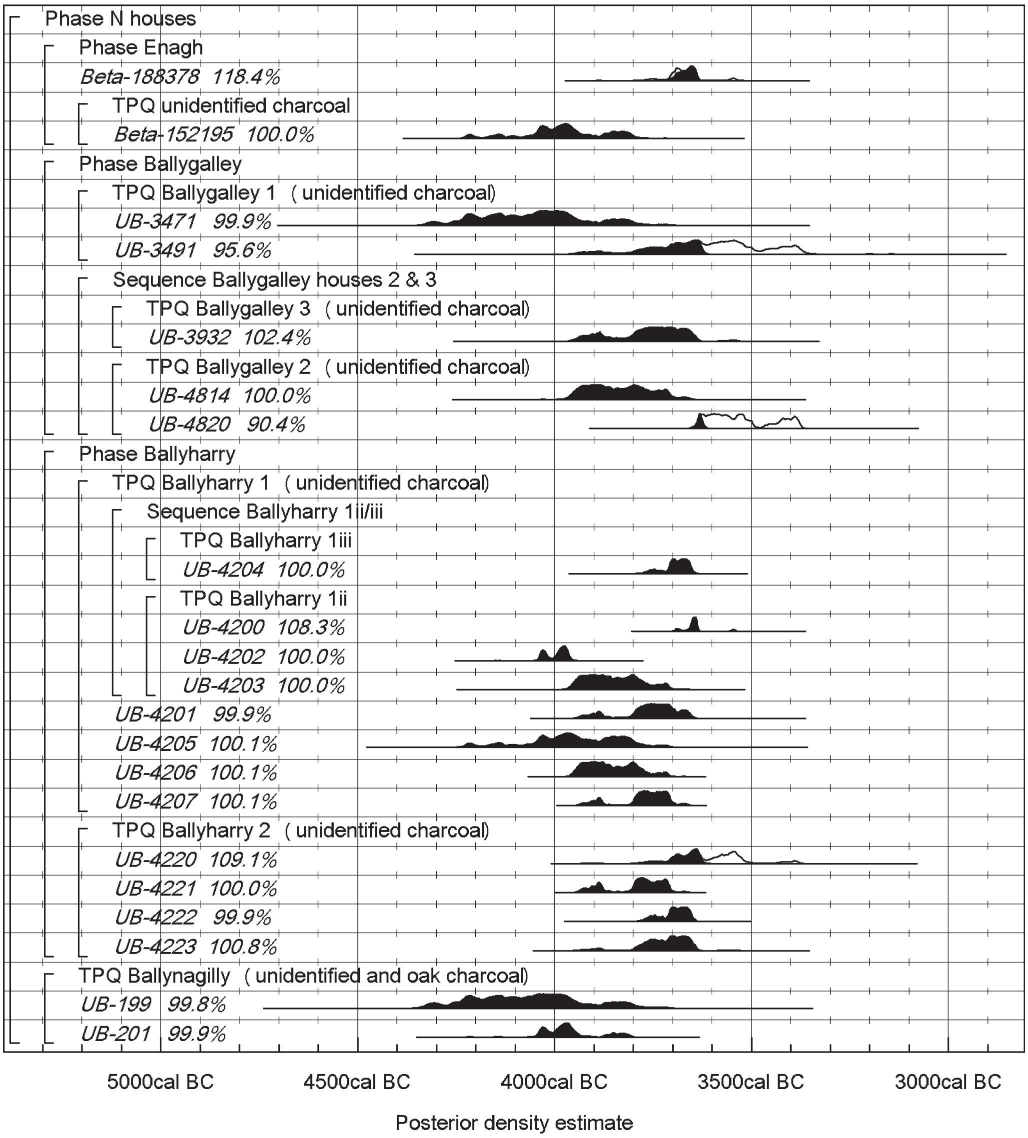

Fig. 12.23. Early Neolithic houses in Ireland (northern). Probability distributions of dates. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.22 and its other components are shown in Figs 12.24–7.

end (D. Simpson 1996, 123–7). The pottery from these features and adjacent pits is provisionally described as 'western Neolithic', with decoration confined to finger-tip fluting and occasional incised lines (D. Simpson 1995, 41; cf. Simpson *et al.* 1990, fig. 7:1–3, 5, 18–20), i.e. modified Carinated Bowl as defined by Sheridan (1995). The area was sealed by a cobbled surface, which included sherds of coarse and more elaborately decorated globular bowls. This also occurred in the topsoil (D. Simpson 1993, 62; 1995, 41; cf. Simpson *et al*. 1990, fig. 7:21–2, 25–6). To the south, across a palaeochannel, on site 2, were further features, including Structure 4 (2.70 m by 2.20 m) and Houses 2 (6.60 m by 5.20 m) and 3 (5 m by 3 m), all defined by wall slots and posts. House 2 preceded House 3 on the stratigraphic evidence of ard marks which cut the wall slots of House 2 (Simpson *et al*. 1995, 4) and were cut by one of the postholes of House 3. Site 2 was also covered by a stone layer.

Bulk samples of unidentified charcoal were dated from the foundation trenches of Houses 1–3, all the samples providing *termini post quos* for construction (Fig. 12.23). Seventeen other unidentified bulk charcoal samples from discrete features, principally pits, were dated to the fourth millennium cal BC. These are listed in Table 12.13, but are not included in the overall model for early Neolithic activity presented here because, at the present stage of post-excavation analysis, it is not clear which were associated with the earlier phases of Neolithic activity at the site, and which with the later.

Two houses were revealed in advance of gas pipeline installation at Ballyharry, on the Islandmagee peninsula, Co. Antrim (Moore 2003; 2004). House 1 showed a complex sequence. Phase 1 consisted of a sub-rectangular arrangement, some 13 m by 6.50 m, of stone-packed postholes, from which posts had been removed. There was little associated material. Phase 2 was a trapezoidal

Table 12.3. Radiocarbon dates for rectangular buildings in Ireland. Posterior density estimates derive from the model defined in Figs 12.22–7.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Enagh, Co. Derry								
Beta-152195		Charcoal (unidentified)	Site 2, F205, context 204. Charcoal-rich fill of foundation trench (McSparron 2003)	5170±70			4230–3790	*4230–4195 (3%)* or *4170–4125 (6%)* or *4120–4085 (2%)* or *4080–3790 (84%)*
Beta-188378		Charred hazelnut shell fragments	Site 2, F207, context 208. Basal fill of corner posthole of house (McSparron 2003)	4880±40	−24.9		3720–3540	*3700–3635*
Ballygalley house 1, Co. Antrim								
UB-3471	BG 91 F22	Charcoal (unidentified, 'a bulk sample from sieving many kilos of soil' — Simpson 1996, 129)	Ballygalley 1. Foundation trench	5219±104	−26.6		4330–3780	*4325–4290 (2%)* or *4270–3790 (93%)*
UB-3491	BG 91 22/2	Charcoal (unidentified, 'from a more concentrated sample [than UB-3471]' — Simpson 1996, 129)	Ballygalley 1. North slot trench (F1022)	4830±117	−24.8		3940–3360	*3945–3850 (11%)* or *3815–3615 (84%)*
Ballygalley house 2, Co. Antrim								
UB-4814	Grid 5 Context 2374	Charcoal (unidentified)	Ballygalley 2. South slot trench, joining 2041 (F2374; Dermot Moore pers comm.)	5035±60	−26.4		3970–3660	*3965–3700*
UB-4820	Tr S Context 2041	Charcoal (unidentified)	Ballygalley 2. South slot trench (F2041)	4749±51	−26.9		3650–3370	*3660–3610*
Ballygalley house 3, Co. Antrim								
UB-3932	BG 94 427	Charcoal (unidentified)	Ballygalley 3. South slot trench (F2427; Dermot Moore pers comm.)	4953±74	−26.8		3960–3630	*3945–3850 (19%)* or *3825–3635 (76%)*
Ballyharry 1, Co. Antrim								
UB-4201	BTP4 (A)	Charcoal (unidentified)	Context 97 (fill)	4968±48	−25.9		3940–3640	*3940–3870 (13%)* or *3815–3645 (82%)*
UB-4200	BTP4 (A)	Charcoal (unidentified)	Context 79 (fill). Phase ii of structure	4854±25	−25.9		3700–3630	*3695–3630*
UB-4202	BTP4 (B)	Charcoal (unidentified)	Context 37 (fill). South wall slot (F37). Phase ii of structure	5184±25	−25.3		4050–3950	*4045–4010 (31%)* or *4005–3955 (64%)*
UB-4203	BTP4 (B)	Charcoal (unidentified)	Context 118 (fill) of north wall slot (F117). Phase ii of structure	5047±48	−25.6		3970–3700	*3960–3755 (89%)* or *3745–3710 (6%)*
UB-4204	BTP4 (C)	Charcoal (unidentified)	Deposit F67, context 66. Phase iii of structure	4921±27	−26.2		3770–3640	*3765–3720 (14%)* or *3715–3645 (81%)*
UB-4205	BTP4 (C)	Charcoal (unidentified)	Context 201 (fill)	5149±87	−26.2		4230–3710	*4230–4195 (3%)* or *4175–3760 (91%)* or *3735–3710 (1%)*
UB-4206	BTP4 (D)	Charcoal (unidentified)	Context 66 (fill)	5044±39	−25.9		3960–3710	*3955–3755 (92%)* or *3740–3710 (3%)*
UB-4207	BTP4 (D)	Charcoal (unidentified)	Context 125 (fill)	4988±33	−25.9		3940–3690	*3935–3870 (15%)* or *3810–3690 (78%)* or *3680–3660 (2%)*
Ballyharry 2, Co. Antrim								
UB-4220	BTP5	Charcoal (unidentified)	Context 3 (fill)	4840±67	−25.8		3770–3380	*3775–3620*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
UB-4221	BTP5	Charcoal (unidentified)	Slot fill (F11)	4998±32	−26.0		3940–3700	*3940–3855* (*23%*) or *3815–3695* (*72%*)
UB-4222	BTP5 context 13 (fill)	Charcoal (unidentified)	Slot fill (F13)	4922±32	−25.6		3780–3640	*3770–3645*
UB-4223	BTP5	Charcoal (unidentified)	Context 19 (fill)	4929±51	−25.7		3900–3630	*3895–3880* (*1%*) or *3800–3635* (*94%*)
Ballynagilly, Co. Tyrone								
UB-199		Charcoal (unidentified)	F(L) 149. Posthole of house	5230±125			4340–3770	*4330–3795*
UB-201		*Quercus* sp. charcoal	F (L) 158. Remains of split oak planking, compressed in wall-slot of house (A. Smith *et al.* 1970)	5165±50			4050–3800	*4155–4130* (*1%*) or *4055–3900* (*75%*) or *3885–3795* (*19%*)
Monanny house A, Co. Monaghan								
Wk-17338	C245 S65	*Quercus* sp. charcoal	Burnt post in west wall of House A (Fintan Walsh pers. comm.)	5037±40	−24.4	.	3960–3700	*3955–3755* (*88%*) or *3745–3710* (*7%*)
UB-7595	C110 S26	Charred hazelnut shell fragments recovered by flotation	House A context 110. Primary packing deposit in foundation trench	4897±37	−22.0		3770–3630	*3705–3635*
Monanny house B, Co. Monaghan								
Wk-17341	C555 S324	*Quercus* sp. charcoal	Internal wall of House B (Fintan Walsh pers. comm.)	5048±40	−24.0		3960–3710	*3960–3760* (*93%*) or *3740–3730* (*1%*) or *3725–3710* (*1%*)
Wk-17342	C542 S170	*Quercus* sp. charcoal	Burnt timber in south wall of House B (Fintan Walsh pers. comm.)	5082±64	−25.3		4040–3700	*3990–3710*
UB-7594	C592 S270	Charred hazelnut shell fragments recovered by flotation	House B context 592. Occupation deposit within internal wall of structure, containing over 200 sherds of early Neolithic pottery	4836±37	−21.0		3700–3530	*3695–3625*
Monanny house C, Co. Monaghan								
Wk-17343	C765 S320	*Quercus* sp. charcoal	Burnt post in south wall of House C (Fintan Walsh pers. comm.)	5043±43	−25.0		3960–3700	*3955–3755* (*90%*) or *3745–3710* (*5%*)
Wk-17344	C1050 S470	*Quercus* sp. charcoal	Burnt post in NW corner of House C	4991±47	−25.2		3950–3650	*3945–3855* (*24%*) or *3845–3830* (*1%*) or *3820–3655* (*70%*)
UB-7596	C948 S420	Charred hazelnut shell fragments recovered by flotation	House C context 948. Part of main burnt horizon within north wall foundation trench	4970±37	−22.0		3910–3650	*3715–3645*
Newtown, Co. Meath								
UB-3521	F30 E633: 41	Charcoal (unidentified)	Foundation trench of rectangular structure (E. Halpin pers. comm.)	5033±42	−26.0		3960–3700	*3950–3710*
UB-3522	F30 E633: 42	Charcoal (unidentified)	Foundation trench of rectangular structure (E. Halpin pers. comm.)	4978±32	−25.7		3910–3660	*3910–3875* (*6%*) or *3805–3655* (*89%*)
Knowth, Co. Meath, zone A								
GrN-20179	15.90:1666	Charcoal (unidentified)	From the fill of Foundation Trench 1, under NE part of main tomb (Eogan and Roche 1997)	5080±20	−25.2		3960–3790	*3960–3895* (*30%*) or *3885–3795* (*65%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrN-20180	K90:179	Charcoal (unidentified)	From the fill of Foundation Trench 1, under NE part of main tomb (Eogan and Roche 1997)	5040±15	−24.9		3950–3780	*3945–3855* (*72%*) or *3845–3830* (*1%*) or *3825–3780* (*22%*)
Knowth, Co. Meath, zone B								
GrN-20181	K92:72	Charcoal (unidentified)	From the fill of Foundation Trench 6, on the east side of main tomb (Eogan and Roche 1997)	5345±20	−24.7		4320–4050	*4315–4295* (*3%*) or *4265–4220* (*20%*) or *4210–4145* (*37%*) or *4135–4050* (*35%*)
Knowth tomb 8, Co. Meath								
BM-1076	Sample 2/1970	Charcoal (unidentified)	Pit 6 in sub-rectangular House 1, associated with Neolithic pot sherds, under kerbstone 10 of tomb 8 (Eogan 1984, 215, 241; 1986, 199; Burleigh *et al.* 1976)	4852±71			3780–3380	*3790–3620*
Kishoge, Co. Dublin								
GrN-26770	01E0061:125–6	*Quercus* sp. charcoal	Charred oak planking within 104, the upper fill of F196, the eastern slot trench (O'Donovan 2003, 126)	4880±40	−23.9		3720–3540	*3760–3740* (*3%*) or *3715–3630* (*92%*)
GrN-26771	01E0061:140–17	*Quercus* sp. charcoal	Burnt post within F135, upper fill of north-western slot trench F192 (O'Donovan 2003, 126)	5020±40	−24.7	5008±31	3950–3700	*3945–3855* (*33%*) or *3820–3700* (*62%*)
GrN-26789	01E0061:140–17	Replicate of GrN-26671	From the same context as GrN-26770	4990±50	−24.7	T'=0.2; T'(5%)=3.8; ν=1		
Kilgobbin, Co. Dublin								
UB-6199	03E0306 Area 6 Sample 85 F404	*Quercus* sp. charcoal	F404. Wall footing (Ines Hagen pers. comm.)	4842±45	−25.6		3710–3520	*3710–3625*
UB-6200	03E0306 Area 6 Sample 119 F985	Charred hazelnut shells	F985. Basal fill of internal posthole (Ines Hagen pers. comm.)	4914±42	−25.5		3790–3630	*3705–3635*
Corbally 1, Co. Kildare								
GrA-13701	F13/SS2	Single fragment *Corylus avellana* (unclear if nut or wood)	From internal posthole (F13; Purcell 2002, 46)	4930±50	−25.6		3900–3630	*3710–3635*
GrA-13702	F3/SS59	Single grain *Triticum dicoccum*	From external trench (F3; Purcell 2002, 46)	4880±50	−24.9		3770–3530	*3705–3630*
Beta-118361		Charcoal (unidentified)	From a corner posthole in foundation trench (F23; Purcell 2002, 46)	5220±80			4260–3800	*4260–3925* (*88%*) or *3880–3800* (*7%*)
Corbally 2, Co. Kildare								
GrA-13698	F148/SS177	*Corylus avellana* fragments (unclear if nut or wood)	From an internal posthole (F148; Purcell 2002, 57)	4900±50	−28.9		3790–3540	*3705–3635*
GrA-13700	F53/SS70	Single grain *Triticum dicoccum*	From an internal posthole (F53; Purcell 2002, 57)	4900±50	−23.6		3790–3540	*3705–3635*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
Beta-118362		Charcoal (unidentified)	From an internal posthole (F53; Purcell 2002, 57)	4910±80			3940–3520	*3940–3855* (*11%*) or *3815–3625* (*84%*)
Corbally 3, Co. Kildare								
GrA-13695	F249/SS285	*Corylus avellana* fragments (unclear if nut or wood)	From an internal posthole (F249; Purcell 2002, 67)	4920±50	−25.4		3800–3630	*3705–3635*
GrA-13697	F208/SS265	Single grain *Triticum dicoccum*	From an internal posthole (F208; Purcell 2002, 67)	4910±50	−24.5		3800–3630	*3705–3635*
Corbally 4, Co. Kildare								
GrA-24234	F47-30	Charred hazelnut	From the eastern wall of the foundation trench (Redmond Tobin pers. comm.)	4905±45	−23.2		3780–3630	*3705–3635*
Corbally 5, Co. Kildare								
GrA-24212	F2061.1-286	Cereal remains	From foundation trench (Redmond Tobin pers. comm.)	4885±45	−23.4		3770–3540	*3705–3635*
GrN-28255	F2098-285	Hazelnut and cereal remains	From one of the roof support postholes (Redmond Tobin pers. comm.)	4770±60	−25.8		3660–3370	*3695–3610*
Corbally 6, Co. Kildare								
GrA-24213	F2536-262	Hazelnut and cereal remains	From foundation trench (Redmond Tobin pers. comm.)	4840±45	−25.9		3710–3520	*3695–3625*
Ballyglass Ma 13, Co. Mayo								
SI-1450	E83:432/3	Charcoal (unidentified)	North wall trench (Ó Nualláin *et al.* forthcoming)	4680±95			3650–3100	
SI-1451	E83:436-8	Charcoal (unidentified)	South wall trench (Ó Nualláin *et al.* forthcoming)	4575±90			3630–3010	
SI-1452	E83:446-8	Charcoal (unidentified)	East wall trench (Ó Nualláin *et al.* forthcoming)	4480±90			3500–2900	
SI-1453	E83:442-5	Charcoal (unidentified)	Partition wall trench (Ó Nualláin *et al.* forthcoming)	4530±95			3620–2910	
SI-1454	E83:456	*Quercus* charcoal	Posthole 29 (F62), house (Ó Nualláin *et al.* forthcoming)	4575±105			3640–2920	
Gortaroe, Co. Mayo								
GrN-27799	II 90-34	*Quercus* charcoal	From an internal posthole (Richard Gillespie pers. comm.)	4940±50	−25.3		3910–3630	*3910–3875* (*4%*) or *3805–3635* (*91%*)
GrN-27800	II 109-5	*Alnus* charcoal	From the foundation trench (C5; Richard Gillespie pers. comm.)	4620±50	−27.1		3620–3130	*3640–3610*
Granny 2, Co. Kilkenny								
UB-6315	Context 27314 : Context 179	*Quercus* sp. charcoal	C27314. NE corner posthole of irregular setting of foundation trenches and postholes (Hughes 2005, 148)	5054±38	−26.6		3970–3710	*3960–3765*
Barnagore, Co. Cork								
Beta-171411	02E384F27S16	*Quercus* stake, charred	Remains of *in situ* stake within eastern slot trench but not cutting it (Ed Danaher pers. comm.)	4880±70	−23.4		3950–3630	*3895–3880* (*1%*) or *3800–3620* (*94%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Beta-171412	02E384F88S65	*Quercus* split timber, charred	Vertical grain, on south-facing side of southern slot trench (Ed Danaher pers. comm.)	4950±70	−25.1		3950–3630	*3945-3855* (*17%*) or *3815–3635* (*78%*)
Pepperhill, Co. Cork								
GrN-15476		Charcoal (unidentified, organic fraction measured)	Fragmentary, irregular setting of foundation trench, postholes and gully with early Neolithic artefacts (Gowen 1988, 44–51)	4860±70	−24.0		3790–3510	*3795–3620*
Tankardstown 1, Co. Limerick								
GrN-14713	Tankardstown 42	*Quercus* planking, charred	Foundation trench of sub-quadrangular house with early Neolithic artefacts (Gowen 1988, 26–43; Gowen and Tarbett 1989)	5105±45	−24.2		3990–3780	*3985–3785*
GrN-15386	Tankardstown 44	*Quercus* planking, charred	From the same context as GrN-14713	5005±25	−24.9		3940–3700	*3935–3870* (*25%*) or *3810–3705* (*70%*)
GrN-15387	Tankardstown 46	*Quercus* planking, charred	From the same context as GrN-14713	4880±110	−24.1		3960–3370	*3945–3855* (*15%*) or *3845–3830* (*1%*) or *3825–3620* (*79%*)
OxA-1476	F23 fill 35 1/2	Emmer grain	F23, context 35. Foundation trench (Monk 2000, 76)	4890±80	−26.0		3930–3520	*3705–3625*
OxA-1477	F23 fill 35 2/2	Emmer grain	F23, context 35. Foundation trench (Monk 2000, 76)	4840±80	−26.0		3790–3370	*3705–3620*
Tankardstown 2, Co. Limerick								
GrN-16557	Tankardstown 332	*Quercus* timber, charred	From E wall of central compartment (Gowen and Tarbett 1989; 1990)	4995±20	−25.7		3910–3700	*3905–3875* (*7%*) or *3805–3705* (*88%*)
GrN-16558	Tankardstown 334	*Quercus* timber, charred	From E wall of central compartment (Gowen and Tarbett 1989; 1990)	5070±20	−26.7		3960–3790	*3955–3890* (*34%*) or *3885–3795* (*61%*)
Lough Gur, Co. Limerick								
D-40		Charcoal (unidentified)	First phase of central house at circle L. 'Thin layer of habitation soil defined on the south-western side by a line of large post-pits', confused by another structure elsewhere. Early Neolithic and later pottery present (McAulay and Watts 1961; Grogan and Eogan 1987, 391–415, figs 34–5)	4410±240			3660–2460	
D-41		Charcoal (unidentified)	Posthole of house dated by D-40 (McAulay and Watts 1961; Grogan and Eogan 1987, 391–415, figs 34–5)	4690±240			3980–2870	
Cloghers, Co. Kerry								
Beta-134226	98E0238:138	Charred hazelnut shell(s)	From basal fill of posthole in western internal wall (Kiely and Dunne 2005, 41)	4850±40			3710–3530	*3695–3630*
Beta-134227	98E0238:153	Charred hazelnut shell(s)	From fill in eastern section of northern wall (Kiely and Dunne 2005, 41)	4900±40			3770–3630	*3705–3635*

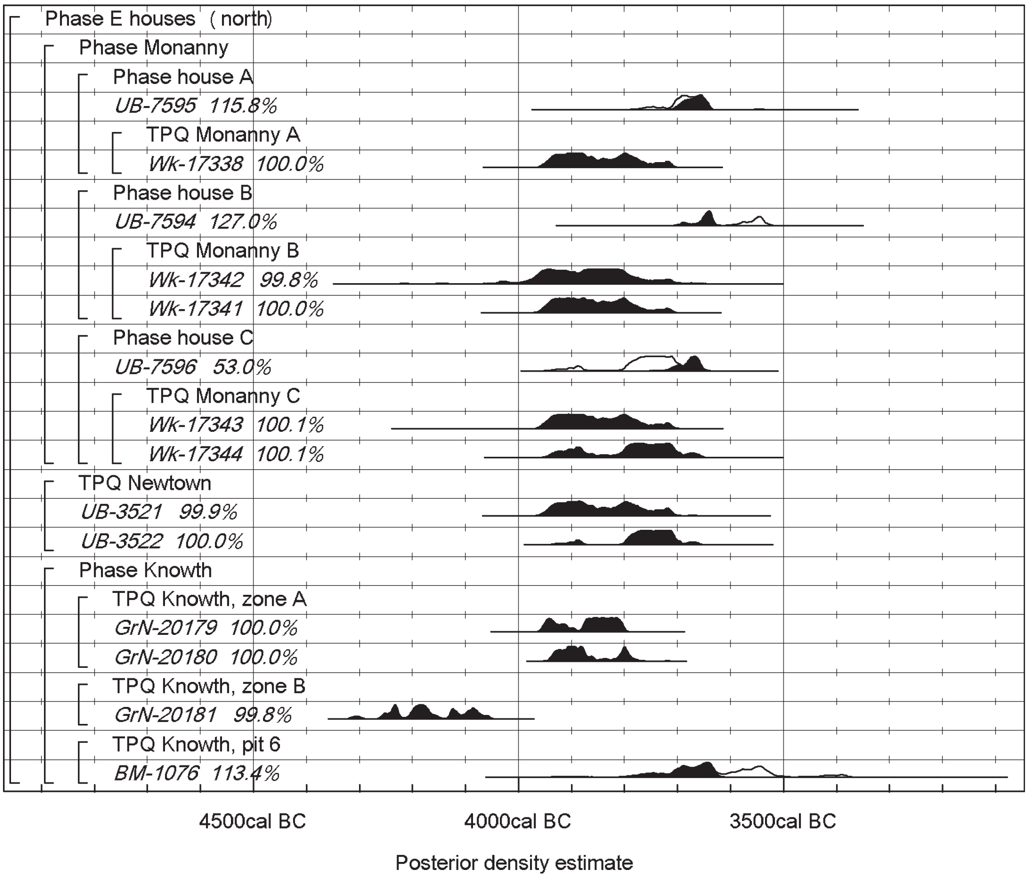

Fig. 12.24. Early Neolithic houses in Ireland (eastern (north)). Probability distributions of dates. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.22 and its other components are shown in Figs 12.23 and 12.25–7.

structure, some 7 m by 5 m, defined by wall slots containing posts and planks, and with a later annexe; a further ancillary rectangular structure was located to the north, though the full layout of this was not revealed. There was a wide variety of associated lithics, including porcellanite. These phase 2 structures were burnt and 34 leaf-shaped arrowheads, some burnt and broken, have been associated with this episode. Phase 3 saw some reconstruction and deliberate deposition of finds, and Phase 4 consisted of a series of large shallow pits, containing among other things flakes of tuff (Group VI) axeheads. Plain Carinated and uncarinated Bowl pottery was found. There were carbonised remains of cereals and charred hazelnut shells, and there were also finds of burnt animal bone. Eight radiocarbon measurements were obtained from unidentified charcoal providing *termini post quos* for their contexts. Four of these samples can be assigned only to House 1, although a further three have been assigned to its Phase 2 and one to its Phase 3 (Dermot Moore and Cormac McSparron, pers. comm.). This relative dating has been incorporated into the chronological model (Fig. 12.23).

House 2 at Ballyharry was only partially revealed, as a rectangular structure some 5.70 m wide but of uncertain length, defined by foundation trenches. Four radiocarbon measurements were obtained on unidentified charcoal samples (Table 12.3), and so are treated as *termini post quos* for the construction and use of the structure (Fig. 12.23).

A rectangular house was excavated at Ballynagilly, Co. Tyrone, in advance of gravel quarrying (ApSimon 1969; 1976). This measured some 6.50 m by 6 m, defined by foundation trenches on the long sides, containing principally split oak planks, and internal postholes and two hearths. Associated material included plain Carinated Bowl pottery (ApSimon 1969, 167). A broader area around the house was excavated but no further early Neolithic structures were found, although several pits were recorded. Two radiocarbon measurements were obtained from charcoal samples directly associated with the house but which potentially contained long-lived timber. Both have been treated as *termini post quos* for the construction of the house (Fig. 12.23).

Turning to the eastern (north) group, three rectangular houses, two very close together, were excavated at Monanny, Co. Monaghan, in advance of road construction (Walsh 2004). All three were defined by foundation trenches. House C measured some 12 m by 7 m, and its near neighbour House B some 13.50 m by 8 m, with an internal cross-division. House A was some 10 m by 7 m; its foundation trench was not found on one long side, perhaps because of erosion. From the foundation trenches of all

three structures came substantial quantities of fine, plain, Carinated Bowl pottery, some worked lithics, including a polished stone axehead of porphyritic andesite from House B and hazelnut shells. There were also pits and gullies containing Carinated Bowl pottery. Eight radiocarbon determinations were obtained from oak charcoal and charred hazelnut shells from the Neolithic houses (Table 12.3). In House A, a measurement on a burnt post in the west wall (*Wk-17338*) is statistically inconsistent with another result from charred hazelnut shell from the same structure (Fig. 12.24; Table 12.3: *UB-7595*; T'=0.6.1; T'(5%)=3.8; ν=1). Similarly, a date on charred hazelnut shell from House B (*UB-7594*) is significantly later than those from structural oak charcoal (*Wk-17341–2*; T'=18.1; T'(5%)=6.0.8; ν=2). In contrast, measurements on two burnt posts, one estimated as 0.15 m in diameter, from House C (*Wk-17343–4*) are statistically consistent with a result on charred hazelnut shell from the same building (*UB-7596*; T'=1.7; T'(5%)=6.0; ν=2). The five dates on oak charcoal have been included in the model as *termini post quos* for the construction of the houses, with the measurements on nutshells providing dates for the use of the structures. In two of the houses the old wood effect introduced by the dating of oak charcoal is demonstrably significant. This bias may, however, amount to no more than a few decades for House C. This is suggested by the consistency of the radiocarbon determinations from this house and by the relatively slight diameter of one of the posts.

The partial remains of a rectangular house were excavated at Newtown, Co. Meath, along with an associated ancillary structure of less regular form, and pits and finds (E. Halpin 1995). The house was some 7 m wide and at least 10 m long, defined by foundation trenches (containing stone packing and some postholes) and some internal postholes. Little detailed information is available on associated material, but there are finds of pottery. Two radiocarbon measurements were obtained on unidentified bulk charcoal samples from the foundation trenches (*UB-3521–2*), providing *termini post quos* for the use of the structure (Fig. 12.24). Two other radiocarbon measurements were obtained on charcoal samples from one of the pits (Table 12.13: UB-3568–9), but as we could not ascertain what the associated material was, these have not been included in the model. Cereals have been noted from the site (Monk 2000), but we are uncertain from which specific contexts.

The remains of at least three structures were identified in the first two phases of occupation at Knowth, Co. Meath (Eogan 1984, 211–44; Eogan and Roche 1997). From what was defined as the first stage of occupation, on the north-east (Zone A) and east side (Zone B) of the main mound, site 1 (Eogan and Roche 1997, fig. 1), two structures, represented by foundation trenches 1–3 (Zone A) and 4–6 (Zone B), were identified from the partially excavated features. Others can be suspected on the basis of further but incomplete foundation trenches (Eogan and Roche 1997, 7–21). In Zone A, two statistically consistent radiocarbon measurements (*GrN-20179*, *-20180*; T'=2.6; T'(5%)=3.8; ν=1) were obtained from charcoal from Foundation Trench 1 (Eogan and Roche 1997, 9). In Zone B, a single radiocarbon measurement (*GrN-20181*) was obtained from charcoal from Foundation Trench 6 (Eogan and Roche 1997, 18). All three dates have been treated as *termini post quos* for their contexts (Fig. 12.24). A further measurement (GrN-18773) was obtained on another sample of bulk charcoal from zone A, but has not been included in the model because there were no associated artefacts in Zone A (Eogan and Roche 1997, 7).

On the west side of the main mound, (Eogan 1984, 211–19; Eogan and Roche 1997, 43–4), a sub-rectangular structure, House B, measuring some 12.30 by 10.10 m and defined by a foundation trench was assigned to the second phase ('developed Western') of occupation on the site. This underlay the outer of two arcs of palisade, and both the structure and the palisade trench were beneath the small passage tomb mound 8 (Eogan 1984, 211–19; 1986; Eogan and Roche 1997, 43–4). Within the structure was Pit 6, which contained slightly modified Carinated Bowl (Eogan 1984, 218, figs 765–7, 804–21; Sheridan 1995, 7), a flake retouched to a point and other lithics (Eogan 1984, 218, fig. 77: 823–6), as well as unidentified charcoal which provided a bulk sample for *BM-1076*, which has been treated as a *terminus post quem* for its context (Fig. 12.24). Part of a further, undated, rectangular structure (House A) was found during the excavation of the western tomb of the main mound (Eogan and Roche 1998).

In the eastern (south) group, a roughly rectangular house was excavated at Kishoge, Co. Dublin, in advance of development (O'Donovan 2003; 2004). This measured some 6 m by 4.50 m, defined by foundation trenches holding oak posts and planks. There were two internal postholes. Minor modifications had taken place in a short use-life which ended in the burning of the structure (O'Donovan 2003; 2004, 5). Only one pottery sherd was found, in a pit outside the house, and some scrapers and flakes were recovered. Three samples of oak charcoal were dated from wall planks, two of the samples being replicate measurements on the same post (GrN-26771, -26789; *F135*). These are statistically consistent (T'=0.2; T'(5%)=3.8; ν=1). A third measurement (*GrN-26770*) is significantly later (T'=6.6; T'(5%)=6.0; ν=2). These results are treated as *termini post quos* for their contexts (Fig. 12.25).

A rectangular house, Structure 3, was excavated at Kilgobbin, Co. Dublin (Ines Hagen, pers. comm.). This was some 9 m by 7 m, defined by foundation trenches (containing evidence for both posts and planks) and both internal and external postholes. Postholes and pits were also found nearby. Associated material included some Carinated Bowl sherds and a leaf-shaped arrowhead. A radiocarbon determination (*UB-6199*) was obtained on an oak charcoal sample from the foundation trench, and another (*UB-6200*) on hazelnut shells from one of the internal postholes. The first of these samples provides a *terminus post quem* for its context, while the second may date the use of the structure (Fig. 12.25).

Three rectangular houses (Houses 1–3) were excavated

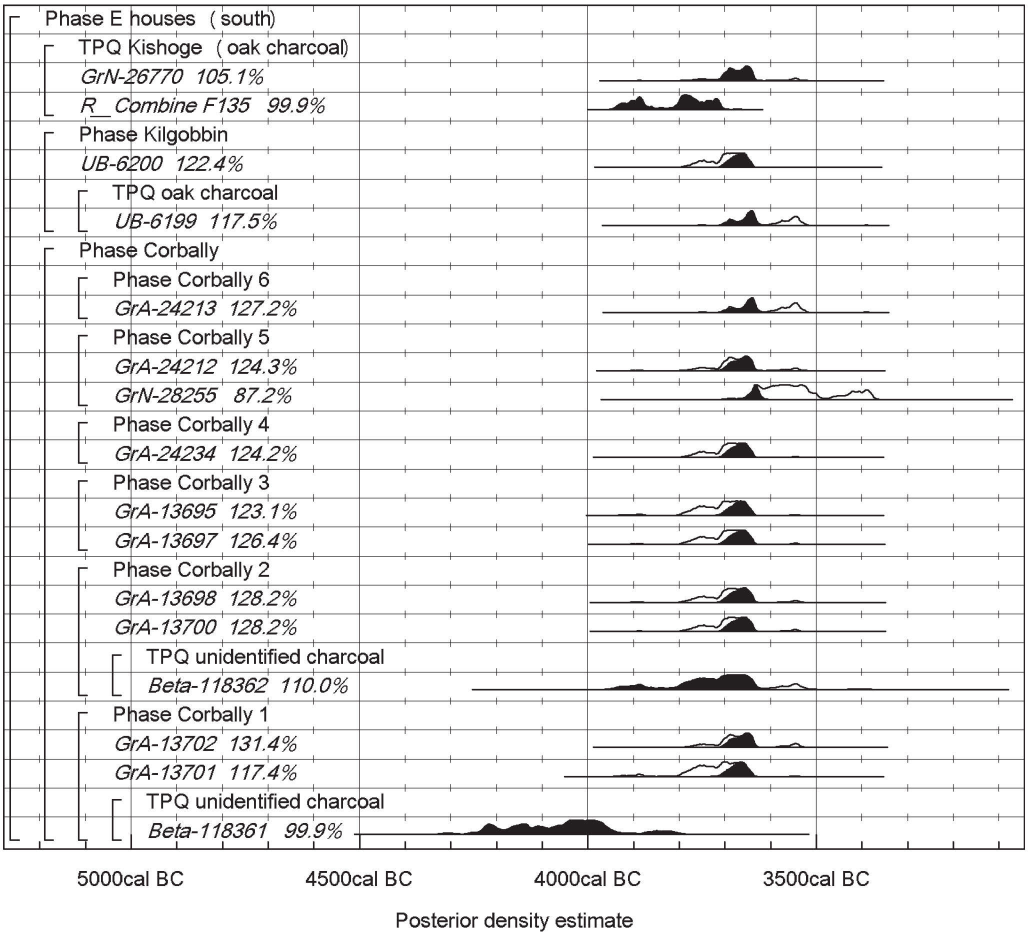

Fig. 12.25. Early Neolithic houses in Ireland (eastern (south)). Probability distributions. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.22 and its other components are shown in Figs 12.23–4 and 12.26–7.

close together in advance of gravel quarrying at Corbally, Kilcullen, Co. Kildare (Purcell 2002), and a further three, and a possible fourth (Houses 4–7), have been recorded 60–100 m to the south-west (Purcell 2002, 33; Tobin 2002; Redmond Tobin, pers. comm.; Smyth 2007, fig. 6). House 1 measured some 11 m by 6.70 m, with an internal division and, like both its neighbours, was defined by foundation trenches and internal and external postholes; a sequence of modifications could be suggested. Associated material included Carinated Bowl sherds, two flint leaf-shaped arrowheads and scrapers, a slate spearhead and a dolerite axehead. Small quantities of charred hazelnut shells, wheat and barley were also found. Three radiocarbon measurements were obtained. *GrA-13702* came from a single grain of *Triticum dicoccum* from the external foundation trench, and produced a measurement statistically consistent with that from *GrA-13701* (T'=0.5; T'(5%)=3.8; ν=1), on *Corylus avellana* from an internal posthole, F13, assigned to Phase 3 modifications (Purcell 2002, 43). *Beta-118361*, on unidentified charcoal, is significantly earlier than the other two measurements (T'=13.8; T'(5%)=6.0; ν=2). It came from a corner posthole in the foundation trench, F23, and has been treated as a *terminus post quem* for the construction of the house (Fig. 12.25).

House 2 measured 10.70 m by some 5 m, defined like House 1 by foundation trenches and also like it with an internal cross-division. A sequence of modifications can again be suggested. Finds included lithics (one a leaf-shaped arrowhead) and Carinated Bowl sherds. Carbonised plant remains included cereal grains and chaff. Three radiocarbon measurements were obtained. *GrA-13700* came from a single grain of *Triticum dicoccum* from one of the central internal postholes, F53; *Beta-118362* was measured on unidentified charcoal from the same feature; and *GrA-13698* on *Corylus avellana* from another internal posthole, F148, assigned to the second building phase (Purcell 2002, 54). The three measurements are statistically consistent (T'=0.0; T'(5%)=6.0; ν=2), although *Beta-118362* is treated as a *terminus post quem* for its context as it may incorporate a slight age offset (Fig. 12.25).

House 3 was a simpler, sub-rectangular, single-phase construction, measuring some 7.30 m by 6.40 m, its foundation trench containing evidence for plank walls. Carinated Bowl sherds, lithics, including a leaf-shaped arrowhead, grain and chaff were found in the foundation trench. Two statistically consistent radiocarbon measurements were obtained (T'=0.0; T'(5%)=3.8; ν=1). *GrA-13697* came from a single grain of *Triticum dicoccum*

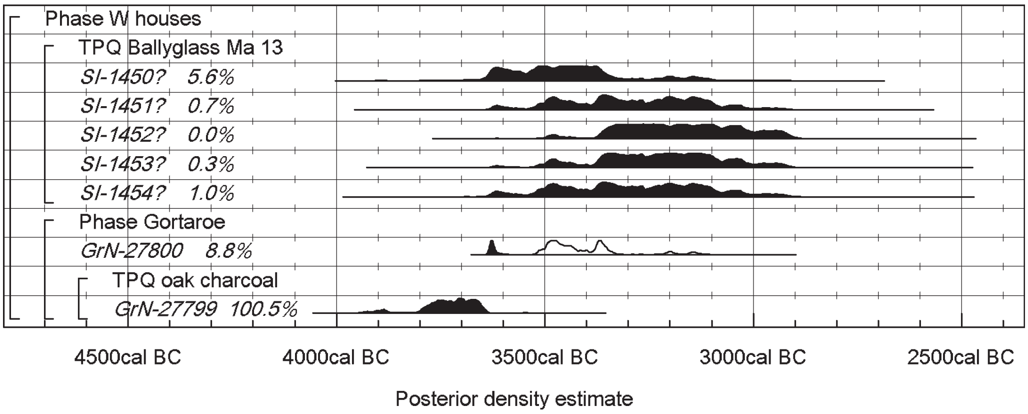

Fig. 12.26. Early Neolithic houses in Ireland (western). Probability distributions of dates. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.22 and its other components are shown in Figs 12.23–5 and 12.27.

from an internal posthole, F208; and *GrA-13695* on *Corylus avellana* came from another internal posthole, F249. These provide dates for the use of the structure (Fig. 12.25).

Further radiocarbon measurements were obtained from Houses 4–6 (Redmond Tobin, pers. comm.). House 4 measured some 10 m by 7 m and was defined by a bedding trench containing the burnt remains of upright oak planks which had been replaced by flimsier panels. Finds included large quantities of pottery and lithics, as well as a stone axehead which had been placed in the foundation trench and charred seeds, chaff and hazelnut shells. One hazelnut shell fragment from the eastern foundation trench was the sample for *GrA-24234* (Fig. 12.25). House 5, at right-angles to House 4, was much poorer in finds, and measured only 7 m by 5 m. It too was defined by a bedding trench, the oak planks in which had burnt along the west side (Tobin 2002, 186). *GrA-24212* was measured on cereal remains from the foundation trench and *GrN-28255* on hazelnut and cereal remains from an internal posthole. The two results are statistically consistent (T'=2.3; T'(5%)=3.8; ν=1). House 6, on the same axis as House 5 and to the west of it, was identified more tentatively and yielded a high density of seeds and chaff (Tobin 2002, 186–7). *GrA-24213* was measured on hazelnut and cereal remains from the foundation trench. The samples from all of these three houses date their use (Fig. 12.25).

Turning to the west (Fig. 12.26), a rectangular house, some 13 m by 6 m, defined by foundation trenches and postholes, was found underlying the court tomb (Ma 13) at Ballyglass, Co. Mayo (Ó Nualláin 1972; Ó Nualláin *et al.* forthcoming). The excavator has suggested that the house may have been deliberately demolished (Ó Nualláin 1972, 54–5). Plain Carinated Bowl pottery was associated with it. Five samples of bulk charcoal were obtained from the house and produced statistically consistent radiocarbon measurements (Fig. 12.26; T'=2.5; T'(5%)=9.5; ν=4). Of these, one (SI-1454) was identified as oak. These dates should provide *termini post quos* for construction, but are excluded from the model because, like Smithsonian Institution dates for samples from the other Ballyglass court tomb (Ma 14; see Ó Nualláin 1998) and the Céide Fields (Tables 12.5–6), they seem anomalously recent for their contexts. It has not been possible to establish how the samples were prepared and measured, although other samples dated by the Smithsonian Institution were prepared as described by Stuckenrath and Mielke (1973) and dated by GPC of methane (Mielke and Long 1969). Further radiocarbon dates recently obtained from Ma 13 confirm that the Smithsonian measurements are anomalous.[4]

A rectangular house was excavated at Gortaroe, just north of Westport, Co. Mayo (Gillespie 2002; Richard Gillespie, pers. comm.). Measuring some 9.80 m by 6.60 m, it was defined by a foundation trench with packing stones, suggesting a split plank wall and internal postholes and stakeholes. Associated finds included flint and chert leaf-shaped arrowheads and scrapers and one body sherd. Charred hazelnuts and one grain of *Hordeum vulgare* were recovered. Two statistically inconsistent radiocarbon measurements (T'=20.5; T'(5%)=3.8; ν=1) were obtained from samples directly associated with the structure. *GrN-27799* came from oak charcoal from an internal posthole (context 34) and has been treated as a *terminus post quem* for the use of the structure; *GrN-27800* came from alder charcoal from the foundation trench (context 5) and dates the construction of the house (Fig. 12.26).

Turning finally to the southern grouping (Fig. 12.27), two structures were excavated in advance of road construction just outside Waterford at Granny, Co. Kilkenny (Hughes 2005). Structure 1 was rectangular, over 6 m by 5 m, defined by foundation trenches and perhaps by external postholes. Finds included a possible leaf-shaped arrowhead and sherds of Carinated Bowl pottery. Structure 2, 9 m to the south-east, was less regular, consisting of an L-shaped foundation trench, and other postholes, very short foundation trenches and a pit. Associated material included a chert leaf-shaped arrowhead and a small quantity of Carinated Bowl pottery. A single radiocarbon measurement (*UB-6315*) was obtained on oak charcoal from one of the postholes, and has been treated as a *terminus post quem* for the construction of Structure 2 (Fig. 12.27).

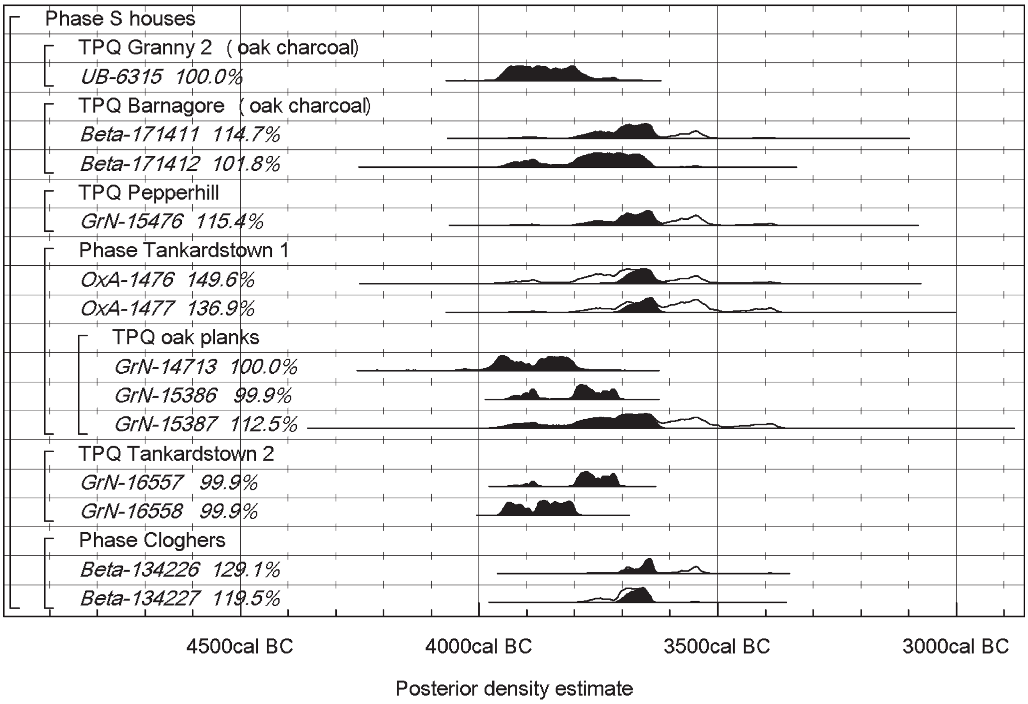

Fig. 12.27. Early Neolithic houses in Ireland (southern). Probability distributions of dates. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.22 and its other components are shown in Figs 12.23–6.

A rectangular house was excavated in advance of road construction at Barnagore, west of Cork, Co. Cork (Danaher 2003; 2009). This measured 6.40 m by 5.40 m, defined by foundation trenches, which had held split timber planks on one long and one short side, and panels of wickerwork or wattle and daub on the others. No artefacts or animal bones were recovered. The structure appeared to have been burnt down. Two statistically consistent radiocarbon measurements (T'=0.5; T'(5%)=3.8; ν=1) were obtained from the structure. *Beta-171411* was measured on a charred oak stake from within the east foundation trench, and *Beta-171412* on a charred split timber from the southern foundation trench. Both have been treated as *termini post quos* for the construction of the house (Fig. 12.27). It is possible, however, that *Beta-171411*, from a stake, may have been a relatively slight timber with an age offset of only a few decades.

A probable but severely truncated house was found at Pepperhill, Co. Cork, in advance of gas pipeline construction (Gowen 1988). A length of foundation trench and associated postholes were associated with plain Carinated Bowl pottery. A single radiocarbon measurement (*GrN-15476*) was obtained on unidentified charcoal from the foundation trench and is treated as a *terminus post quem* for the construction of the structure (Fig. 12.27)

Excavation in advance of a gas pipeline at Tankardstown, Co. Limerick (Gowen 1988, 30), revealed the rectangular foundation trench of a burnt plank house (House 1), 7.40 m by 6.40 m, with two main internal postholes and other small internal features. The foundation trench had held split planks, with stone packing and posts at the corners and midway on the long sides. Associated finds, mainly from the upper fill of the foundation trench, included a lozenge-shaped flint arrowhead, worked quartz and chert, and some small sherds of plain fine Carinated Bowl pottery (Gowen 1988, 34, figs 8–9). Carbonised remains of *Triticum dicoccum* were recovered in some quantity (Gowen 1988, 41). Five radiocarbon measurements were obtained, three on samples from charred oak planks (*GrN-14713*, -15386–7), and two on wheat grains (*OxA-1476–7*). The measurements on the wheat grains are statistically consistent (T'=0.2; T'(5%)=3.8; ν=1), and may date the use of the structure (Fig. 12.27). They are significantly later than those on the oak planks (T'=12.5; T'(5%)=9.5; ν=4), which have been used as *termini post quos* for their contexts (Fig. 12.27). Further excavations revealed a second, larger, rectangular structure (House 2), some 20 m to the north-west (Gowen 1988; Gowen and Tarbett 1988; 1989; 1990). This too was defined by a foundation trench, measuring some 15.50 by 7.50 m, with two internal cross-divisions. Associated material includes plain, fine 'classic' Carinated Bowl pottery. Two statistically inconsistent radiocarbon measurements (*GrN-16557-8*; T'=7.0; T'(5%)=3.8; ν=1) were obtained on charred oak timbers from the east wall of the central compartment, and have been treated as *termini post quos* for the construction of the house (Fig. 12.27).

To the north-east of Tankardstown is the well known site of Lough Gur with the focus of Neolithic settlement activity on Knockadoon, for long the key site for Irish Neolithic settlement. Ó Ríordáin's major report on his campaign of excavation in the 1940s and 1950s (Ó Ríordáin 1954) was followed by the later publication of other unpublished sites (Grogan and Eogan 1987). Recent excavation has demonstrated the extent of Bronze

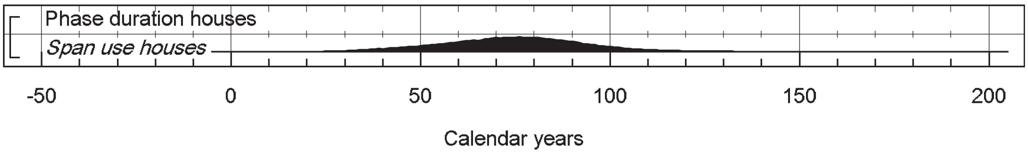

Fig. 12.28. Early Neolithic houses in Ireland. Probability distribution of the number of years during which they were constructed and used, derived from the model shown in Figs 12.22–7.

Age activity there (Cleary 1993; 1995; 2003) and has suggested that some structures previously thought of as Neolithic may be of Bronze Age date. This has given rise to debate about the initiation and significance of Neolithic settlement at Knockadoon, the ceramic sequence and the date of the settlement structures (Grogan 2005; Cooney 2007b). Resolution is not advanced by the fact that there are a limited number of radiocarbon dates covering the Neolithic period here, and that two of them (Table 12.3: D-40–1), from the central house at circle L, were measured in the very early days of the method. In this context, while there is clearly early Neolithic activity at Lough Gur, the site cannot add much to the present discussion, and the dates are not included in the model.

At Cloghers, just outside Tralee, Co. Kerry, a rectangular house was revealed by excavation in advance of housing development (Kiely 2003; Kiely and Dunne 2005). The structure, defined by foundation trenches (containing postholes and split planks) and postholes, was some 7.8 m by 13 m. It was associated with Carinated Bowl pottery, worked lithics of various materials, and remains of hazelnuts, bread wheat, barley, oats and perhaps spelt; some calcined bones of cattle and sheep came from a pit outside the house. Two statistically consistent radiocarbon measurements (T'=0.8; T'(5%)=3.8; ν=1) were obtained on hazelnuts directly associated with pottery (*Beta-134227*, *-134226*), from the northern wall of the house and the basal fill of a posthole in the west internal wall, respectively. They date the use of the house (Fig. 12.27).

Chronologies for early Neolithic houses in Ireland

The model defined in Figs 12.22–7 suggests that the construction and use of early Neolithic houses in Ireland began in *3730–3660 cal BC* (*95% probability*; Fig. 12.22: *start houses*), probably in *3715–3680 cal BC* (*68% probability*). These structures were in use until *3640–3605 cal BC* (*95% probability*; Fig. 12.22: *end houses*), probably until *3635–3615 cal BC* (*68% probability*). This model suggests that the activity represented by the use of these rectangular structures lasted for a relatively restricted period of time: *30–115 years* (*95% probability*; Fig. 12.28: *use houses*), probably for *55–95 years* (*68% probability*). In social and human terms this represents perhaps only three or four generations.[5]

Sixty-eight radiocarbon determinations are included in this model, from 30 different structures. At first sight, this seems an impressive assemblage, but only 20 of the measurements are on short-life material which provides more than a *terminus post quem* for the construction or demolition of the structure concerned. These 20 dates on short-life material come from 14 houses. Again these appear to provide a representative sample, but six of these houses and ten of the short-life samples come from the single site of Corbally. Given this, it is necessary to examine the robustness of this model.

As previously observed (McSparron 2003; 2008), the dates on short-life material form a highly coherent group. The model shows good overall agreement ($A_{overall}$=122.5%; Fig. 12.22) and all the dates which provide *termini post quos* are in good agreement with the end date for the use of rectangular houses calculated by the model. The only outlier is the bulk sample of alder charcoal from Gortaroe (Fig. 12.26: *GrN-27800*; A=9.9%), which falls rather later than the rest. This determination may simply be a statistical outlier, not unexpected in a series of this size.

To investigate further the sensitivity of our results to the existing limited suite of short-life samples, we have to assess the possibility that the model defined in Figs 12.22–12.27 is unduly influenced by the number of dates from Corbally. If Corbally happened to be of short overall life within a longer-lasting phenomenon of house construction and use this site may be biasing the sample. For this reason, an alternative model has been constructed (Fig. 12.29). This is of identical form to that shown in Fig. 12.22, but in this case the two oak samples from Monanny House C (Fig. 12.24) and *Beta-171411* from Barnagore (Fig. 12.27) have been interpreted as close in age to the construction of the structures from which they derive. This could be the case since the undifferentiated oak samples in question appear to have come from relatively slight timbers. This model suggests that houses may have begun perhaps a generation earlier, in *3770–3675 cal BC* (*95% probability*; Fig. 12.29: *start houses* (sensitivity analysis)), probably in *3740–3695 cal BC* (*68% probability*). The estimate for the time when houses went out of use in this reading changes little and is *3635–3600 cal BC* (*95% probability*; Fig. 12.29: *end houses* (sensitivity analysis)), probably *3630–3615 cal BC* (*68% probability*). In this case, houses were in use for *45–155 years* (*95% probability*; distribution not shown), probably for *70–125 years*.

This analysis demonstrates once again the importance of submitting short-life, single-entity samples for radiocarbon dating (Ashmore 1999a). The precision of the date estimates and the apparently short duration of this phenomenon mean that even a relatively small old-wood offset (say, from a timber that was 50 years-old when felled) is of significance in our statistical modelling and archaeological interpretation.

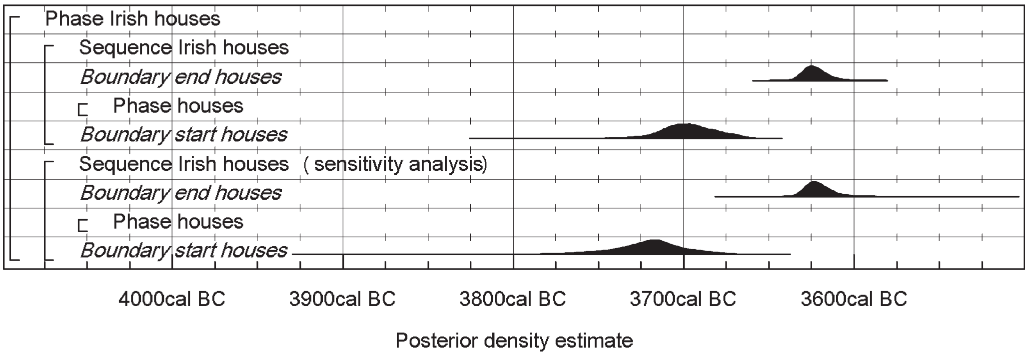

Fig. 12.29. Early Neolithic houses in Ireland. Probability distributions for the dates when they were constructed and used, derived from the model shown in Figs 12. 22–7 and the alternative model described in the text.

It emerges from this analysis as of the outmost importance to date a more representative selection of houses – with short-life, single-entity samples. On present evidence, we prefer the shorter chronology suggested by the first model (Figs 12.22–7), because it relies only on samples that are known to be short-life. A very slightly longer chronology, however, cannot be ruled out at this stage.

It is hard to over-emphasise the significance of these chronologies for understanding both early Neolithic rectangular houses in their own right and the early Neolithic in Ireland as a whole, as already argued by Cormac McSparron (2003; 2008). The numbers of these structures have increased dramatically over recent years, and they have been taken as a powerful icon of the different nature of the early Neolithic in Ireland as compared with southern Britain, denoting a sedentary existence based around house-based residential units, and very possibly also the expression of a different process of initiation of the Neolithic in Ireland, involving colonisation (Cooney 2000a; Cooney 2007a; Grogan 2003; Rowley-Conwy 2004; R. Bradley 2007; among many other references). On the basis of the chronological models proposed above, a radically different perspective emerges. These structures cannot be seen as belonging necessarily to the whole of the Irish early Neolithic, but to a tightly defined horizon within it, probably confined to a duration of three to four, or four to five, generations. This use centres on the first three quarters of the 37th century cal BC (Fig. 12.29, upper). So why did these buildings suddenly become fashionable and can their social role be recast?

Are these generations when houses were current also the first generations of the Irish Neolithic as a whole? We come back to this question when models for the start of the Neolithic in Ireland are presented below (Chapter 12.4).

Do the models also affect our view of whether these structures were part of a sedentary existence? Size is one argument that the houses have a residential function. The Irish structures cluster between 5 m and 11 m in length and include no examples comparable with large, hall-like British buildings like those at White Horse Stone (Chapter 7), Yarnton (Chapter 8) or in Scotland (Chapter 14), although at Mullaghbuoy on the Islandmagee peninsula, Co. Antrim, in the north-east (McManus 2004) two structures tacked onto one another give a total length of *c.* 24 m. It is possible that form and location here indicate a link with the contemporary Scottish hall tradition (see Chapter 14.7). If houses were bases for sedentary existence, however, why were they in use for such a short period of time? The brief timescales involved might still be compatible with a style of living rooted in particular places, with people using as a residential base structures which could have endured for at least a generation, extended by rebuilding in some cases. As a variant on this, this particular expression of attachment to place could have emerged at a particular historical moment as a chosen social strategy on the part of what have been termed house societies (Cooney 2003; R. Bradley 2007; Borić 2008).

In either case, there are other dimensions of houses to consider, where again the brief currency of the phenomenon is central. Cross (2003) has proposed that they could have been loci for feasting, although the food remains from them have not yet been published in sufficient detail to support or refute this particular interpretation. A recent review of the totality of the evidence for Irish early Neolithic settlement has emphasised how the houses fit into a wider pattern of varied occupation and activity in the landscape. Both the foundation and ending of many were marked by series of placed deposits and their use was diverse and variable (Smyth 2006; 2007; 2011). Smyth argues persuasively that the burning which ended the histories of many of these structures was the result of sustained, purposeful effort, perhaps linked to turning points in individual or group life cycles. She sees a shared house 'template' and tradition in island-wide similarities in materials, methods of construction and size (Smyth 2006; 2007; 2011).

Is it coincidental that the brief currency of houses in Ireland was contemporary with the introduction and most intensive period of construction of enclosures in southern Britain? More directly in the Irish context, it is *85% probable* that both the enclosures at both Magheraboy and Donegore were built before the start of the Irish house tradition, and *99.8% probable* that both enclosures continued in use after the house tradition. The obvious distinctions between houses and enclosures are those of scale and brevity. Most enclosures would have encompassed more people and some had longer sequences of use. But episodes of

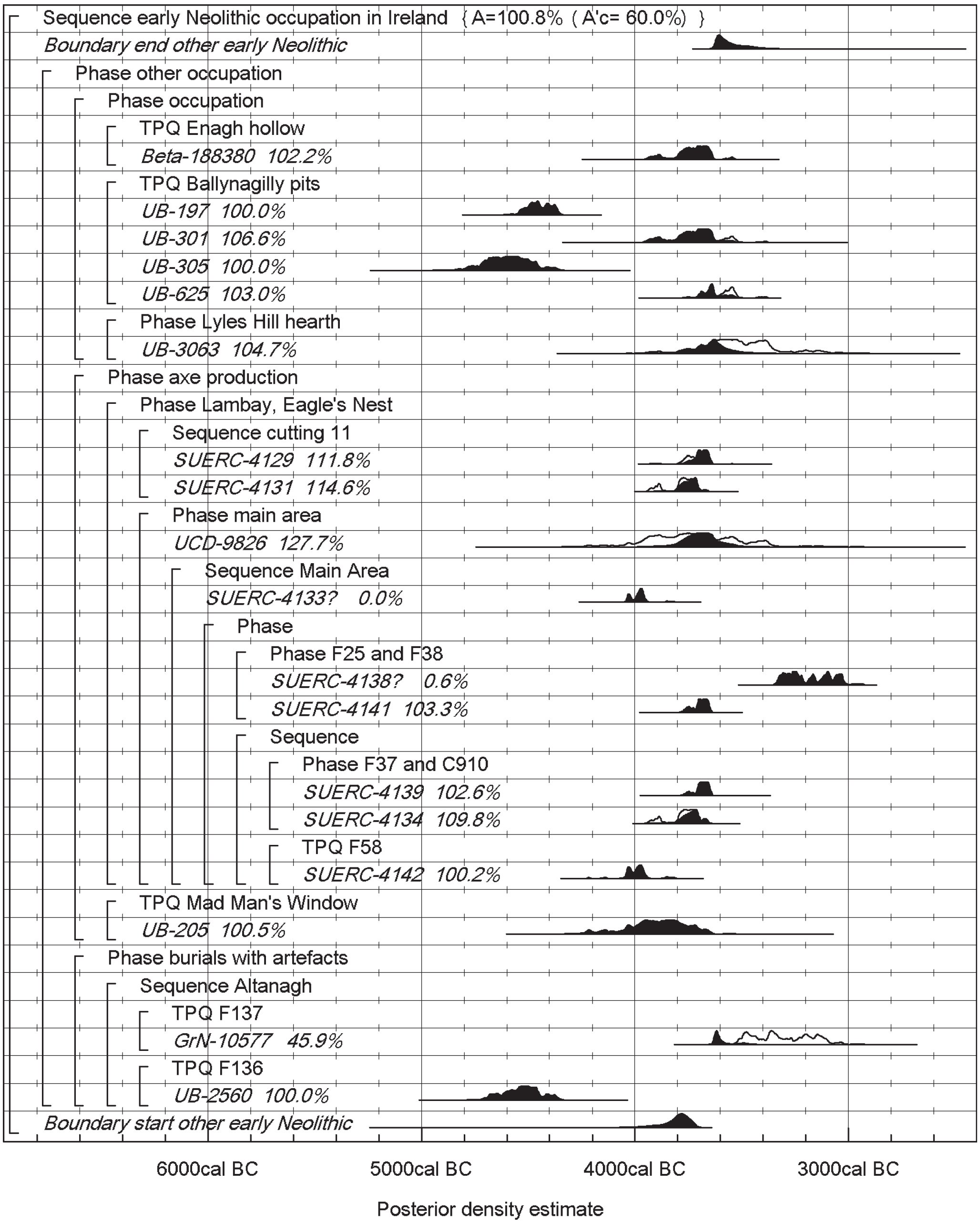

Fig. 12.30. Other contexts associated with diagnostically early Neolithic cultural material. Probability distributions of dates. The format is identical to that of Fig. 12.6. The large square brackets down the left-hand side, along with the OxCal keywords, define the overall model exactly.

activity at some enclosures can be broken down in terms of both temporality and scale, so that the differences may be relative rather than absolute. Indeed Smyth (2006, 243) has noted the similarities between open house sites like Ballygalley and those set within the palisaded enclosure at Thornhill, Co. Derry (Logue 2003). Houses and enclosures shared certain roles. Houses may have brought numbers of people together for both construction and very possibly for ending by demolition or burning as well. The births and deaths, as well as the lives, of houses were accompanied by purposeful depositions (Smyth 2006; 2007). At least some houses can be seen as nodes in systems of movement and exchange of materials across the landscape, as argued by Derek Simpson for Ballygalley (1996), a role also attributed to the Thornhill settlement. Houses marked place, and gave meaning to chosen parts of the landscape. Their use involved repetition, and to some extent rebuildings, for example as seen at Ballyharry and Corbally.

Given this degree of overlap, if we think in terms of social strategies that emerge at particular historical moments, could there be a link between the appearance of rectangular houses in Ireland and the appearance of causewayed enclosures, principally in southern Britain? Do both reflect a similar kind of sociality, expressed in different forms and distributed differently through their respective landscapes, both social forms that respect a

physical template but are used in quite varied ways? Or did different kinds of more complex interaction take place at and through enclosures? We discuss the Irish houses further in relation to other evidence for the Irish early Neolithic below, and again in relation to southern British and Scottish evidence in Chapters 14.8–9 and 15; and the scarcity of enclosures in Ireland is also considered in a broader perspective in Chapter 15.9.

Other early Neolithic occupation and activity

Houses are not the only manifestation of settlement in the early Neolithic in Ireland, though they have attracted much recent coverage. Other features including spreads of artefacts, pits, hearths and scattered postholes and stakeholes are also known, some in the general vicinity of houses, and others on their own (Cooney 2000a; Grogan 2004, 103; Smyth 2007; McQuade *et al*. 2009). In addition to the houses and features within them containing diagnostically early Neolithic material culture presented above, some other early Neolithic occupation sites have also been dated (Table 12.4). We also present dating for other activity, including axehead production.

A hollow 200 m east of the house at Enagh produced five small body sherds of what appears to be Carinated Bowl pottery and unidentified charcoal, which provides a *terminus post quem* for this activity (Fig. 12.30: *Beta-188380*).

At Ballynagilly, four samples of charcoal were dated from various pit contexts around the house, all associated with early Neolithic material. Three of the samples (*UB-301*, *-305*, *-625*) are unidentified and so provide *termini post quos* for the features from which they were recovered (Fig. 12.30). Two of these samples (*UB-301*, *-625*) provide *termini post quos* in the second quarter of the fourth millennium cal BC. The third (*UB-305*) is of mid-fifth millennium cal BC date. A fourth sample (UB-197) consisted of pine charcoal, providing a date of 4550–4350 cal BC (95% confidence; Table 12.4). These two fifth millennium dates, along with four other unidentified charcoal samples of similar age but unassociated with diagnostic material (Table 12.13), were first taken to support a very early date for the start of the Neolithic in Ireland (ApSimon 1976), but were subsequently interpreted as probably old wood (Kinnes 1988; Sheridan 1995, 7; Cooney 2000a, 13). Pine generally does not live as long as oak (Mitchell 1974) and an old-wood offset of more than a few hundred years at the outside is improbable. Either, therefore, we must revive the idea that Ballynagilly is by far the earliest Neolithic settlement in Ireland and Britain, or the charcoal dated by UB-197 must have been redeposited from an earlier feature, or derived from a bog pine. We strongly incline to the view that the sample was older than its context, because UB-197 is at least several hundred years earlier than any other sample relating to Neolithic artefacts in Ireland, and because it seems too much to base such a radical argument on a single date.

At Lyles Hill, although there is no doubting the quantities of early Neolithic material (E. Evans 1953; Sheridan 1995, 7; Cooney 2000a, 113; Nelis 2003, 216), it is now, as noted above, unlikely that the enclosure is of Neolithic date. Several radiocarbon dates have been obtained from the site (Simpson and Gibson 1989). *UB-3063*, on barley from a hearth associated with 'modified' Carinated Bowl pottery (Sheridan 2001), provides a date for some of this early Neolithic activity (Fig. 12.30). Two other samples are associated with unweathered Carinated Bowl, but are on unidentified charcoal, from the inner and outer palisades respectively (UB-3074, -3062). The date of these palisades is uncertain, although, given these *termini post quos,* they appear to be of third millennium cal BC date or later (Table 12.4). Two other samples, also on unidentified charcoal, came from the top of the buried soil under the enclosure bank and from the core of the bank respectively (UB-3061, -3060), and post-date the Neolithic (Table 12.4). In these circumstances, it seems most plausible to interpret the palisades as part of a later enclosure of the hilltop, whether or not it was the same episode as that represented by the earthwork, and the early Neolithic pottery from them as redeposited.

Dates are available for two axehead production sites. Excavations at Eagle's Nest, Lambay Island, Co. Dublin, recovered evidence for the extraction and working of porphyry (porphyritic andesite; Cooney 2005). This is a medium-grained volcanic lithology which was worked by hammering and pecking with some flaking. Excavation took place in two small adjoining valleys defined by porphyry outcrops. All stages of axehead production, from quarrying to grinding or polishing, took place at the production site, where there is also evidence for formal, structured deposition. Four samples of short-life charcoal were submitted from debitage layers in one of the excavated quarry areas (Cutting 11). Two of these (SUERC-4130, -4132) produced dates falling in the eighth and seventh millennia cal BC and must have been redeposited (Table 12.4). The other two samples (*SUERC-4129*, *-4131*) produced measurements which are statistically consistent ($T'=1.5$; $T'(5\%)=3.8$; $\nu=1$), and are in good agreement with the stratigraphic sequence (Fig. 12.30).

From the main area of depositional activity on the floor of the eastern valley, a sample of oak charcoal (*SUERC-4142*) from pit F58 provides a *terminus post quem* for the overlying deposits, including F37 and context C910. Feature 37, a polygonal slab setting placed over a pit concentration (of which pit F58 forms a part), produced a radiocarbon measurement on *Prunus* sp. charcoal (*SUERC-4139*). Context C910, a dark brown loam deposit with a rich artefact assemblage including flint and jasper artefacts, produced another measurement (*SUERC-4134*) on a fragment of alder charcoal. These last two samples provided statistically consistent radiocarbon determinations ($T'=1.7$; $T'(5\%)=3.8$; $\nu=1$), which are in good agreement with the measurement from pit F58 below (Fig. 12.30). Samples have been dated from two other features. F38, a deposit of porphyry debitage and sediment in a hollow, produced a measurement on a fragment of alder charcoal (*SUERC-4141*), and the fill of F25, a linear cut, produced

Table 12.4. Radiocarbon dates for other early Neolithic activity in Ireland. Posterior density estimates derive from the model defined in Fig. 12.30.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Enagh, Co. Derry							
Beta-188380		Charcoal (unidentified)	Site 3, F305, context 302. Upper fill of depression containing early Neolithic pottery, 200 m away from site 2 (McSparron 2003)	5170±70		4230–3790	*3945–3855* (*12%*) or *3825–3630* (*83%*)
Ballynagilly, Co. Tyrone, discrete features							
UB-197	L67.32	*Pinus* sp. charcoal	Pit (F135). Pit containing hearth debris and Carinated Bowl sherds, 7 m south of house in Square L (A. Smith *et al.* 1970)	5625±50		4550–4350	*4550–4350*
UB-301	L67.11, L67.12	Charcoal (unidentified)	Pit F (L) 134) with early Neolithic pottery, 30 m E of house (A. Smith *et al.* 1971)	4910±90		3950–3520	*3950–3620* (*92%*) or *3590–3535* (*3%*)
UB-305	L67.48	Charcoal (unidentified)	Pit F (L) 16. Hearth pit with early Neolithic pottery, 15 m SE of house (A. Smith *et al.* 1971)	5745±90		4800–4360	*4790–4440* (*91%*) or *4425–4370* (*4%*)
UB-625	L67.40-43, 67.50-1, 67.65	Charcoal (unidentified)	F162. Pit with early Neolithic pottery, isolated (Arthur ApSimon pers. comm.)	4835±55	−24.8	3710–3510	*3760–3740* (*1%*) or *3715–3520* (*94%*)
Lyles Hill, Co. Antrim							
UB-3063		*Hordeum* sp.	Hearth with modified Carinated Bowl pottery (Sheridan 2001; Simpson and Gibson 1989). Measurement communicated by Queen's University, Belfast	4765±135	−30.6	3900–3110	*3800–3475*
UB-3074		Charcoal (unidentified)	Inner palisade, with unweathered Carinated Bowl pottery (Sheridan 2001; Simpson and Gibson 1989). Measurement communicated by Queen's University, Belfast	4433±40	−26.1	3340–2910	
UB-3062		Charcoal (unidentified)	Outer palisade, with unweathered Carinated Bowl pottery (Sheridan 2001; Simpson and Gibson 1989). Measurement communicated by Queen's University, Belfast	3974±165	−23.5	2910–1980	
UB-3061		Charcoal (unidentified)	Top of buried soil beneath enclosure bank (Simpson and Gibson 1989). Measurement communicated by Queen's University, Belfast	3386±100	−26.6	1940–1440	
UB-3060		Charcoal (unidentified)	Core of bank (Simpson and Gibson 1989). Measurement communicated by Queen's University, Belfast	3229±115	−26.4	1760–1260	
UB-3058		Charcoal (unidentified)	Gravel capping of bank (Simpson and Gibson 1989). Measurement communicated by Queen's University, Belfast	1958±130	−26.8	360 cal BC–cal AD 380	
UB-3059		Charcoal (unidentified)	Posthole (Simpson and Gibson 1989). Measurement communicated by Queen's University, Belfast	1796±55	−27.0	cal AD 80–390	
Eagle's Nest, Lambay Island, Co. Dublin							
SUERC-4130		*Prunus* sp. charcoal	C1108. Porphyry debitage layer associated with the production of stone axeheads	8070±40	−24.7	7140–6840	
SUERC-4132		*Prunus* sp. charcoal	C1112. Porphyry debitage layer associated with the production of stone axeheads	7965±40	−24.8	7050–6680	
SUERC-4131		*Prunus* sp. charcoal	C1109. Debitage layer, stratified below sample for SUERC-4129	4990±35	−24.4	3940–3660	*3810–3665*
SUERC-4129		*Corylus avellana* charcoal	C1106. Debitage layer, stratified above sample for SUERC-4131	4925±40	−25.3	3790–3640	*3755–3640*
SUERC-4138		*Prunus* sp. charcoal	Main area, F25. Linear cut	4460±35	−26.2	3350–3010	
SUERC-4141		*Alnus glutinosa* charcoal	Main area, F38. Deposit of porphyry debitage and associated sediment in a hollow	4920±35	−29.3	3780–3640	*3765–3640*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
SUERC-4142		*Quercus* sp. charcoal	Main area, F58. Pit	5180±45	−25.3	4050–3940	*4225–4205* (*1%*) or *4160–4130* (*2%*) or *4070–3930* (*85%*) or *3875–3805* (*7%*)
SUERC-4139		*Prunus* sp. charcoal	Main area, F37. Polygonal slab setting, stratigraphically later than context of SUERC-4142	4910±35	−25.3	3770–3630	*3765–3640*
SUERC-4134		*Alnus glutinosa* charcoal	Main area, C910. Deliberate deposit of worked flint, charcoal, jasper and other cultural material, stratigraphically later than context of SUERC-4142	4980±40	−25.9	3940–3650	*3800–3655*
SUERC-4133		*Corylus avellana* charcoal	Main area, C904. Deliberate deposit of worked flint, charcoal, jasper and other cultural material	5170±35	−25.1	4050–3940	
UCD-9826		*Prunus* sp. charcoal	Main area pit F1. Stratigraphically isolated pit containing rich artefact assemblage	4930±175		4070–3340	*3875–3510*
Mad Man's Window, Co. Antrim							
UB-205		Charcoal (unidentified)	Site 1. Spread of charcoal in soil formed on large slab of rock and preserved under basalt scree, associated with Carinated Bowl, a scatter of flint debitage and several roughouts for flint axeheads (Woodman 1992, 78)	5095±120		4240–3540	*4230–4195* (*2%*) or *4170–4125* (*3%*) or *4120–4090* (*2%*) or *4080–3645* (*88%*)
Altanagh, Co. Tyrone							
UB-2560		Charcoal (unidentified)	Irregular pit, F136, with Carinated Bowl sherds, polished stone axeheads etc., overlain by burial F137 (context of GrN-10557)	5685±70	−26.3	4710–4350	*4690–4365*
GrN-10577		Charcoal (unidentified)	F137. Oval, stone-lined pit containing bones of two individuals, Bowl pottery and lithics. Overlay pit F136 (context of UB-2560) On same hilltop as badly damaged megalith, possibly a court tomb (B. Williams 1986)	4590±80	−23.7	3630–3020	*3655–3545* (*78%*) or *3540–3430* (*17%*)

a result from a fragment of *Prunus* sp. charcoal (*SUERC-4138*). Both of these samples, along with those from Feature 37 and context C910, are stratigraphically earlier than a fragment of short-life, hazel charcoal (*SUERC-4133*) from context C904. This measurement, however, has poor agreement with the samples from the contexts beneath (A=6.7%) and must be reworked. A bulk sample of *Prunus* sp. charcoal (*UCD-9826*) was also dated from F1, a stratigraphically isolated pit that contained a rich artefact assemblage including porphyry debitage and associated hammerstones, struck flint and middle Neolithic pottery, which raises the probability that the charcoal was derived from earlier activity at the site.

When the eighth to seventh millennium cal BC dates (SUERC-4130, -4132) are disregarded, six of the seven remaining measurements of single-entity short-life charcoal samples are statistically consistent (T'=4.2; T'(5%)=11.1; ν=5). These dates may suggest a fairly short period of porphyry exploitation for axe production falling in the 38th or 37th centuries cal BC (Fig. 12.30). SUERC-4138 may date a later episode of activity falling in the third quarter of the fourth millennium cal BC, perhaps relating to the middle Neolithic pottery from F1, and so has been excluded from the model for early Neolithic activity at Lambay. It is an open question whether there may have been earlier exploitation of the porphyry source. There is obviously residual charcoal on the site, evidenced by the eighth and seventh millennia cal BC dates. There are no Mesolithic lithics on the site but there is definite evidence for Mesolithic activity on the island (Dolan and Cooney 2010). The sample for SUERC-4133 was redeposited in the context from which it was recovered, and the depositional activity could have disturbed charcoal from earlier deposits. It does, however, provide a measurement on a short-life charcoal sample dating to the decades around 4000 cal BC. Whether this can be taken as an indicator of the beginning of the working of the porphyry source is debatable.

At Mad Man's Window, Co. Antrim (Woodman 1992), a small area of Neolithic activity (Site 1) was preserved under a basalt scree where soil had developed on a rock-cut platform. This was one of a number of Neolithic chipping floors investigated during the rebuilding of the Antrim coast road. Within the soil and on top of a large slab of rock, there was a spread of charcoal associated with Carinated Bowl, a scatter of flint debitage and several roughouts for flint axeheads (Woodman 1992, 78). Unidentified charcoal produced a date of 4240–3540 cal BC (95% confidence; Table 12.4: UB-205). This date provides a *terminus post quem* for the artefacts and axe production. It should be noted that Site 1 stands out from the other sites at Mad Man's Window where flint axe production was more dispersed (Woodman 1992, 84–6).

An early Neolithic burial from Altanagh, Co. Tyrone (Williams 1986) can be included here. Unidentified charcoal (*UB-2560*) from an irregular pit, F136, with finds including Carinated Bowl sherds and polished stone axeheads, provides a *terminus post quem* for a feature above it. This was an oval, stone-lined pit (F137), containing

the bones of two individuals, Bowl pottery and lithics. In turn, this produced another sample of unidentified charcoal (*GrN-10577*), which provides a *terminus post quem* for this secondary activity (Fig. 12.30).

A chronology for early Neolithic occupation and other activity

The model for occupation and other activity associated with culturally diagnostic early Neolithic material is shown in Fig. 12.30. This suggests that this activity began in *4000–3700 cal BC* (*95% probability*; Fig. 12.30: *start other early Neolithic*), probably in *3840–3725 cal BC* (*68% probability*). It ended in *3645–3360 cal BC* (*95% probability*; Fig. 12.30: *end other early Neolithic*), probably in *3630–3520 cal BC* (*68% probability*). These estimates are independent of those derived from dates associated with the early Neolithic rectangular houses, so that this sample is not biased by a disproportionate number of dates derived from an intense but short period of house construction in the 37th century cal BC. Consequently, this model provides an independent indication of the appearance of early Neolithic activity and its associated material culture in Ireland. Further radiocarbon dates associated with other, diagnostic Neolithic practices in Ireland are considered below.

Portal, court and related tombs

Generally dispersed across the landscape (Cummings 2009, chapter 6), and with greater concentrations in the northern and eastern parts of the island, portal tombs and court tombs are a striking feature of the Irish Neolithic (e.g. Cody 2002; C. Jones 2007). The architecture of portal tombs appears to emphasise the prominently raised, often tilted, capstone, whether or not that was above a surrounding platform or a more substantial cairn (Ó Nualláin 1983; Shee Twohig 1990; cf. Whittle 2005). The architecture of court tombs combines the frontal (in some cases central) arena of the court with a linear arrangement of stone chambers, within a cairn which in some instances may not have fully covered the chamber (de Valera 1960; Cody 2002). Human remains have been found in both kinds of monument, with burnt or charred bones more common in court tombs (Herity 1987; Cooney and Grogan 1994, fig. 4.14; A. Powell 2005). Both kinds of monument are now generally assigned to the early Neolithic (e.g. ApSimon 1986; Waddell 1998; F. Lynch 2000; Cooney 2000a; Cummings and Whittle 2004), though previously the finds from portal tombs had encouraged a dating to later in the Neolithic (e.g. Herity 1982; cf. Herity 1987**)**. It has been long recognised that there are structural affinities between portal and court tombs, with chambers of portal tomb form occurring in court tombs (see discussion in Waddell 1998, 91–2). The court tomb at Ballymacaldrack provides a clear link with a non-megalithic monumental funerary tradition in the early Neolithic in Ireland (Sheridan 2006a). Two sites within this non-megalithic tradition are discussed below.

Portal tombs

The dating of portal tombs is challenging because their chambers could have remained accessible for an extended period after construction. Finds include early Neolithic artefacts, but also later ones (Herity 1982; Shee Twohig 1990; Waddell 1998; Kytmannow 2008). Many have been investigated, though few by modern excavation, and Poulnabrone is the only one site with a sequence of radiocarbon dates. Ballykeel, Co. Armagh, produced a date in the first half of the second millennium cal BC from charcoal in the cairn (95% confidence; 3350±45 BP; 1750–1510 cal BC; UB-239; A. Collins 1965), and single dates on human bone have been obtained from three other sites as part of a programme of research on portal tombs, which was published after the modelling reported here was undertaken (Kytmannow 2008, 100–12).[6] Of these, only Ballynacloghy, Co. Galway has produced a radiocarbon date which falls in the Neolithic period, although in the face of the taphonomic complexities of these monuments, it is hard to assess how this single date may relate to the construction and use of the tomb.

At Poulnabrone, on the Burren in Co. Clare, excavation took place in 1985 because of threats to the structural integrity of the monument (A. Lynch 1988; Cooney 2000a; C. Jones 2004). The artefacts from the chamber could be early or middle Neolithic in date (C. Jones 2004, fig. 4). The remains of over 20 people were found in the chamber as a jumbled mass of disarticulated bones, some scorched and burnt after flesh had gone, and many found in cracks in the natural limestone floor (A. Lynch 1988; A. Lynch and Ó Donnabhain 1994; C. Jones 2004, 30).

In interim reports, the excavator, Ann Lynch, has suggested that the disarticulated bones came from corpses originally kept elsewhere, perhaps in caves (Cooney 2000a, 94–7; O'Dowd 2008). One articulated neonate (dated by OxA-1904; Fig. 12.31; Table 12.5) was a significantly later insertion (A. Lynch 1988; 1990; cf. C. Jones 2004, 30). According to an interim statement on the human bone assemblage, a minimum of 22 individuals are represented by 4755 identified bones, including four articulated bone groups; less than 50% of all skeletal elements are present, with an over-representation of carpals and tarsals and discrepancies between upper and lower body elements, especially long bones. These observations all tend to support the original interpretation of secondary burial (Beckett and Robb 2006, 62–3). It remains, however, difficult to assess this interpretation in advance of a full osteological report.

There are three main possibilities. The presence of human bones in cracks in the chamber floor may support the suggestion that some of this material was placed in the chamber soon after its construction and before any sediment had accumulated. If this is the case, then a *terminus ante quem* for the construction of Poulnabrone may be provided by the latest human remains recovered from the deposit of disarticulated bone. The model shown in Fig. 12.31 would then suggest that construction occurred in or after *3290–2520 cal BC* (*95% probability*; Fig. 12.31:

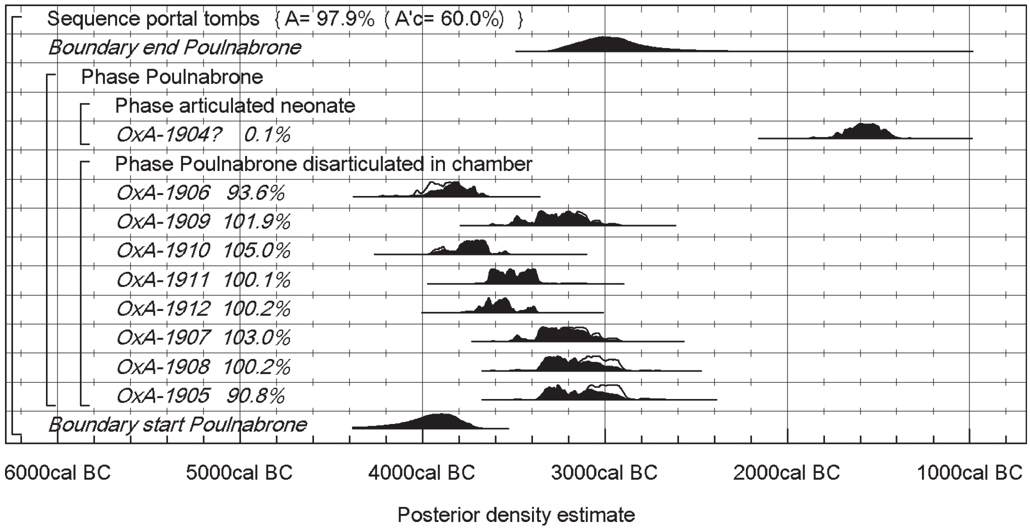

Fig. 12.31. Poulnabrone portal tomb. Probability distributions of dates. The format is identical to that of Fig. 12.6. The large square brackets down the left-hand side, along with the OxCal keywords, define the overall model exactly.

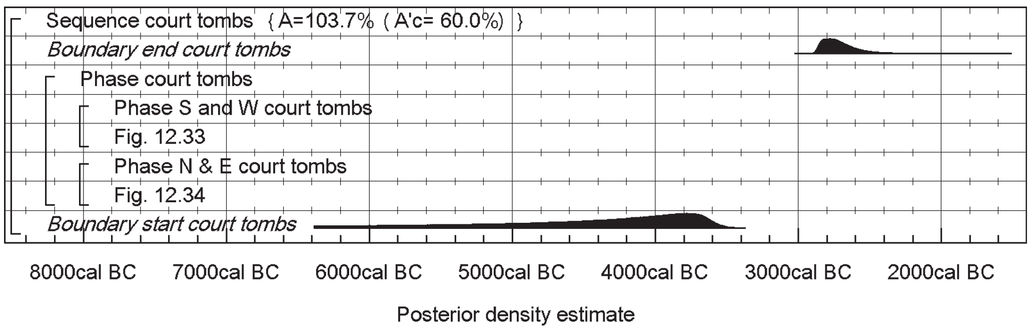

Fig. 12.32. Court tombs and related forms. Overall structure of the chronological model. The component sections are shown in detail in Figs 12.33–4. The large square brackets down the left-hand side of Figs 12.32–4, along with the OxCal keywords, define the overall model exactly.

end Poulnabrone), probably in or after *3165–2830 cal BC* (*68% probability*). If, however, this is not the case, for example if some other formation process, such as later solution, was at play in introducing the bones into the cracks in the limestone, then this estimate simply dates the deposition of the human remains in the chamber, not the construction of the monument itself. Least plausibly, given the uneven representation of skeletal elements, the deposit might be reinterpreted as being made up of individuals interred progressively as fleshed corpses and subsequently rearranged. In this case, the construction of the monument may be dated by the first individual deposited in it, to *4270–3715 cal BC* (*95% probability*; Fig. 12.31: *start Poulnabrone*), probably in *4055–3785 cal BC* (*68% probability*). Better informed readings of the taphonomy must await full publication of the site, and radiocarbon dating of the articulated bone groups. At present, the first interpretation, that of both Lynch, and Beckett and Robb, seems the most probable, with its concomitant late construction date for the monument.

Court tombs

Numerous court tombs have been excavated. Most, however, were investigated in or before the mid-twentieth century, so that, where radiocarbon dates have been obtained, they are mainly on bulk charcoal samples, often unidentified. There are thus *termini post quos* for several monuments (Figs 12.32–4; Table 12.5). Herity's survey of the finds from court tombs (1987) concluded that the Carinated Bowl pottery from pre-cairn contexts was all undecorated, while subsequent contexts, including the burial chambers, also contained decorated Bowl and sometimes vessels in later traditions. The same repertoire of early Neolithic lithics was shared by pre-cairn and chamber contexts.

The most extensive and most recently obtained series of dates is from Parknabinnia on the Burren, Co. Clare, where research excavations took place in 1998–2001 (Table 12.5; C. Jones 2004, 46–51; pers. comm.; in prep.). Here, a sub-ovoid cairn covered an elongated, bipartite chamber like those of court tombs, although there was a narrow entrance passage rather than the more usual expanded court. The associated artefacts are comparable with those from court

Table 12.5. Radiocarbon dates for portal tombs, court tombs and other related monuments in Ireland. Posterior density estimates derive from the models defined in Figs 12.31, 12.32–4 and 12.35.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Poulnabrone portal tomb, Co. Clare							
OxA-1905		Human. R talus, disarticulated	F24. From among disarticulated bone in soil on chamber floor and in natural fissures in limestone beneath it (A. Lynch 1988; R. Hedges *et al.* 1990)	4390±90	−21.0 (assumed)	3360–2870	*3355–2915*
OxA-1906		Human. R talus, disarticulated	F15/F16. As OxA-1905	5100±80	−21.0 (assumed)	4050–3700	*3985–3690* (*93%*) or *3685–3655* (*2%*)
OxA-1907		Human. R talus, disarticulated	F15. As OxA-1905	4520±80	−21.0 (assumed)	3500–2920	*3510–3425* (*7%*) or *3385–3005* (*88%*)
OxA-1908		Human. R talus, disarticulated	F28A. As OxA-1905	4440±80	−21.0 (assumed)	3370–2890	*3360–2940*
OxA-1909		Human. R talus, disarticulated	F28C. As OxA-1905	4550±80	−21.0 (assumed)	3520–3010	*3520–3025*
OxA-1910		Human. R talus, disarticulated	F28C. As OxA-1905	4940±80	−21.0 (assumed)	3960–3530	*3940–3630* (*93%*) or *3565–3535* (*2%*)
OxA-1911		Human. R talus, disarticulated	F15/F16. As OxA-1905	4720±70	−21.0 (assumed)	3650–3350	*3640–3365*
OxA-1912		Human. R talus, disarticulated	F15/F16. As OxA-1905	4810±70	−21.0 (assumed)	3710–3370	*3710–3490* (*82%*) or *3465–3370* (*13%*)
OxA-1904		Human. Bone of neonate	F18A. Undisturbed in a fissure in the natural limestone close to the sill stone at entrance to chamber (A. Lynch 1988, 106; R. Hedges *et al.* 1990)	3290±80	−21.0 (assumed)	1750–1410	
Parknabinnia court tomb-like monument, Co. Clare							
AA-53131	Find 305	Human. Distal R femur	Context 305. Monument of court tomb-like affinities, with bipartite chamber. Samples from chamber (C. Jones 2004)	4645±55	−21.4	3630–3340	*3630–3575* (*6%*) or *3540–3335* (*89%*)
AA-53132	Find 373	Human. Proximal R tibia	Context 335	4235±55	−22.1	2920–2640	*3015–2830* (*80%*) or *2820–2745* (*15%*)
AA-53133	Find 471	Human. Distal R tibia	Context 379	4455±60	−21.4	3360–2910	*3350-3000* (*86%*) or *2995–2925* (*9%*)
AA-53134	Find 549	Human. Skull fragments	Context 388	4640±75	−21.2	3640–3100	*3635–3550* (*8%*) or *3540–3305* (*73%*) or *3240–3100* (*14%*)
AA-53135	Find 555	Human. L scapula fragment	Context 388	4455±60	−21.3	3360–2910	*3350–3000* (*86%*) or *2995–2925* (*9%*)
AA-53136	Find 625	Human. L tibia fragment	Context 389	4195±55	−21.0 (assumed)	2910–2580	*2920–2730*
AA-53137	Find 961	Human. Skull fragments	Context 443	4535±60	−21.4	3500–3020	*3495–3460* (*3%*) or *3375–3075* (*88%*) or *3070–3020* (*4%*)
AA-53138	Find 1725	Human. R pelvis fragment	Context 565	4705±60	−20.7		*3630–3550* (*19%*) or *3545–3365* (*76%*)
AA-53139	Find 1933	Human. Complete L humerus	Context 583	4785±60	−21.0	3700–3370	*3650–3495* (*67%*) or *3465–3370* (*28%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
AA-53140	Find 998	Human. Femur shaft	Context 490	4315±55	−20.5	3090–2870	*3095–2870*
AA-53141	Find 1958	Human. Complete R femur	Context 584	4725±60	−21.2	3650–3360	*3635–3485* (*48%*) or *3475–3370* (*47%*)
AA-53142	Find 2133	Human. R tibia fragments	Context 614	4550±60	−21.6	3500–3020	*3500–3435* (*7%*) or *3380–3085* (*86%*) or *3060–3025* (*2%*)
Primrose Grange court tomb-like monument (no court, but bipartite chamber), 2 km S of Carrowmore, Co. Sligo							
Ua-16969	ID 60337	Bone	From a tomb containing mainly inhumed rather than cremated bone. Leaf arrowheads also present. Samples described as from central chamber, but precise contexts unknown (Burenhult 2001, 12)	4545±80	−22.0	3520–2940	*3520–3010*
Ua-12738	ID 60305	Charcoal	As Ua-16969	4360±80	−27.85	3340–2870	*3340–3205* (*15%*) or *3195–3145* (*4%*) or *3140–2875* (*76%*)
Ua-16967	ID 60354	Charcoal	As Ua-16969	5230±75	−24.9	4260–3810	*4260–3935* (*92%*) or *3865–3810* (*3%*)
Ua-16968	ID 60355	Charcoal	As Ua-16969	5145±75	−26.2	4230-3770	*4230–4200* (*2%*) or *4170–4125* (*3%*) or *4120–4095* (*1%*) or *4080–3760* (*89%*)
Ua-11582	ID 60006	Charcoal	As Ua-16969	5140±65	−24.8	4050–3780	*4160–4130* (*1%*) or *4070–3765* (*94%*)
Ua-12739	ID 60314	Charcoal1[1]	As Ua-16969	4645±70	−21.5	3640–3120	*3635–3320* (*87%*) or *3220–3170* (*4%*) or *3165–3115* (*4%*)
Annaghmare court tomb, Co. Armagh							
UB-241		Charcoal (unidentified)	Court tomb. Sealed behind primary blocking of court (Waterman 1965, fig. 11, fig. 5; A. Smith *et al.* 1970; corrected by A. Smith *et al.* 1971)	4397±55		3340–2890	*3330–3215* (*16%*) or *3185–3155* (*2%*) or *3125–2900* (*77%*)
Ballybriest court tomb, Co. Derry							
UB-534	CH2	Charcoal, unidentified, but deposit described as including hazelnuts and *Corylus* charcoal (E. Evans 1939, 9)	Black layer below cairn of court tomb, associated with Carinated Bowl pottery (A. Smith *et al.* 1973)	4930±80	−25.7	3950–3530	*3950–3630* (*92%*) or *3570–3530* (*3%*)
UB-535	CH5/6	Charcoal	Black layer 4 around Neolithic pot (A. Smith *et al.* 1973)	5045±95	−24.9	4040–3640	*4040–4015* (*1%*) or *3995–3645* (*94%*)
Ballymacdermot court tomb, Co. Armagh							
UB-207		Charcoal (unidentified)	Black deposit (3) ‘below stone blocking’ of inner court (Collins and Wilson 1964, 11, fig. 4; Herity 1987, 158; A. Smith *et al.* 1973)	3660±60		2210–1880	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
UB-695	Sample 5	Charcoal (unidentified)	Brown earth (layer 8) in northern part of western half of Chamber 3, butted against orthostats and overlying charcoal-rich layer (7), with numerous Neolithic sherds at interface of the two (Collins and Wilson 1964, 15, fig. 4, f; A. Smith *et al*. 1974). Could date funerary use of chamber but possibly a mixture of charcoal of different ages	4295±90	−25.7	3270–2630	
UB-694	Sample 4	Charcoal (unidentified)	Brown earth in north part of Chamber 3 together with charcoal from same layer containing Carinated Bowl pottery under flat stone (A. Smith *et al*. 1974). Could possibly date funerary use of chamber	4830±95	−25.1	3800–3370	*3800–3365*
UB-705	Sample 2	Charcoal (unidentified)	Dark soil (3) below stones blocking forecourt (Collins and Wilson 1964, 11, fig. 4; Herity 1987, 158; A. Smith *et al*. 1974)	3515±85	−24.4	2120–1620	
UB-702	Sample 10	Charcoal (unidentified)	Low levels in cracks between lowest cairn stone in cutting 9 (Collins and Wilson 1964, fig. 5	6925±95	−25.1	6010–5630	*5990–5655*
UB-698	Sample 3	Charcoal (unidentified)	Under fill of tightly packed granite blocks and on scattered flat slabs (=continuation of forecourt blocking) in chamber 1 of gallery (Collins and Wilson 1964, 14, fig. 4; A. Smith *et al*. 1974)	4715±190	−24.0	3950–2910	*3935–3870* (*2%*) or *3810–2925* (*93%*)
UB-693	Sample 6	Charcoal (unidentified)	S end of Chamber 3, from dark brown soil (layer 8) containing Carinated Bowl sherds and a little burnt bone	1180±75	−25.7	AD 660–1020	
UB-697	Sample 7	Charcoal (unidentified)	Deposit under large stone in SW corner of chamber 3	940±75	−25.6	AD 970–1260	
UB-700	Sample 8	Charcoal (unidentified)	Among stones and soil overlying pre-cairn soil in cutting 9 through body of cairn (Collins and Wilson 1964, figs 3, 5)	1025±40	−25.2	AD 890–1150	
UB-703	Sample 9	Charcoal (unidentified)	Among stones and soil overlying pre-cairn soil in cutting 9	975±70	−25.3	AD 890–1220	
Creggandevesky court tomb, Co. Tyrone							
UB-2539		Charcoal (unidentified)	'Gallery deposit' in tomb with cremations, flint arrowheads, other lithics, 112 stone beads, 7 fragmentary Carinated Bowls (Foley 1988; Sheridan 1995, 8)	4740±85	−26.8	3700–3350	*3665–3350*
UB-2540		Charcoal (unidentified)	'Gallery deposit' in tomb with cremations, flint arrowheads, other lithics 112 stone beads, 7 fragmentary Carinated Bowls (Foley 1988; Sheridan 1995, 8)	4825±80	−26.2	3780–3370	*3775–3495* (*83%*) or *3465–3375* (*12%*)
Dooey's Cairn, Ballymacaldrack, Co. Antrim							
UB-2045		Charcoal (unidentified)	Forecourt blocking deposit (A. Collins 1976, 2–3, 5, fig. 2)	4630±130		3660–2920	*3655–3005*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
UB-2030		Charcoal (unidentified)	From wall crevices and just above till floor of 'cremation passage' (A. Collins 1976)	5150±90	−23.8	4230–3710	*4230–4195* (*3%*) or *4175–3755* (*91%*) or *3745–3725* (*1%*)
UB-2029		*Quercus* charcoal	Inner end of narrow 'cremation passage', extending beyond chamber, in which were 3 large postpits, possibly from a pre-mound structure. Charcoal probably under paving of passage, which had been removed during 1935 excavations (A. Collins 1976)	4940±50	−23.6	3910–3630	*3915–3875* (*4%*) or *3805–3635* (*91%*)
Tully court tomb, Co. Fermanagh							
UB-2120		Charcoal (unidentified)	Charcoal from Chamber 1, under stone filling (Waterman 1978, fig.5)	4785±85	−23.7	3710–3360	*3710–3365*
UB-2119		Charcoal (unidentified)	Charcoal from Chamber 1 under stone filling (Waterman 1978)	4890±65	−24.2	3800–3520	*3910–3875* (*2%*) or *3805–3620* (*81%*) or *3605–3520* (*12%*)
UB-2116		Charcoal (unidentified). Combined with UB-2118, sample from northern half of chamber	Charcoal from southern half of Chamber 2. UB-2116 sealed by stone filling, but addition to it of UB-2118, from an area lacking stone filling 'must introduce a suspicion of error' (Waterman 1978, 12)	4445±130	−28.8	3520–2780	
UB-2115		Charcoal (unidentified)	Charcoal from surface of forecourt to E of gallery portal, where blocking best preserved (Waterman 1978)	4960±85	−24.5	3960–3530	*3960–3630*
UB-2114		Charcoal (unidentified)	Charcoal under blocking, centre of forecourt (Waterman 1978)	4575±50		3500–3090	*3505–3425* (*16%*) or *3380–3260* (*36%*) or *3255–3095* (*43%*)
Ballyglass Ma 13 court tomb, Co. Mayo							
GrN-24991	E83:468	*Quercus* charcoal	From ash spread (F63), east of house (Ó Nualláin *et al.* forthcoming)	4990±110	−24.2	4040–3530	*4000–3625* (*92%*) or *3585–3530* (*3%*)
Ballyglass, Ma 14 court tomb, Co. Mayo							
SI-1463		Charcoal (unidentified)	Dark layer immediately under cairn of tomb (Ó Nualláin 1998, 128, 141, 143)	4270±90		3100–2620	
Shanballyedmond court tomb, Co. Tipperary							
GrN-11431	Shanballeyedmond no 3	Charcoal (unidentified).	Fragments from postholes in setting of 34, connecting with forecourt horns and running along facade and around entire monument, 0.22 to 0.40 m in diameter (most 0.25 m to 0.30 m; O'Kelly 1958, 40–41, fig. 1; ApSimon 1986). Material from postholes originally identified as 7 fragments of *Corylus* and 4 fragments of *Quercus* (O'Kelly 1958, 72)	4930±60	−25.3	3930–3630	*3940–3870* (*7%*) or *3810–3630* (*88%*)
D-52		Charcoal (unidentified)	From chamber (Herity 1987, 158). Excavator commented that there was doubt as to whether sample was in primary position (McAulay and Watts 1961, 34)	4000±130		2900–2130	

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Rathdooney Beg ovoid mound, Co. Sligo							
Beta-110614		Waterlogged seeds. Plant remains from this context were identified as *Urtica dioica*, *Ranunculus* sub-genus *Batrachium, Rubus fructicosus*, *Sonchus asper, Potamogeton* sp.and Gramineae (B. Collins 1999)	Context 116 (29–31 cm). Waterlogged clay about half way up ditch fill, probably eroded from mound, with fragments of hazel and willow rods, animal bone, charcoal (Mount 1999, fig. 7). Stratified above context 117 (source of sample for Beta-109607). Ditch surrounded large, uninvestigated oval mound, pollen *c.* 70% grass in all three dated contexts	4990±40	−23.8	3940–3660	
Beta-109607		Waterlogged seeds. Plant remains from this context were identified as *Urtica dioica*, *Rumex* sp., *Ranunculus repens/acris*, *Ranunculus* sub-genus *Batrachium, Torilis japonica, Sonchus asper* and Gramineae (B. Collins 1999)	Context 117 (56–58 cm). Waterlogged clay with animal bone, hazel and willow rods and charcoal, immediately below context 116 (source of sample for Beta-110614; Mount 1999, fig. 7)	4940±40	−24.6	3800–3640	*3740–3635*
Beta-109608		Waterlogged seeds. Plant remains from this context were identified as *Rumex* sp., *Stellaria media*, *Ranunculus* sub-genus *Batrachium* and *Torilis* cf. *nododa* (B. Collins 1999)	Context 118 (67–70 cm) Waterlogged clay filling lower part of ditch and underlying context 117 (source of sample for Beta-109607; Mount 1999, fig. 7)	4840±50	−23.7	3710–3520	*3775–3645*
Knockiveagh round mound, Co. Down							
D-37		Charcoal	From surface beneath round mound. Thick brown soil, much charcoal (including hazel, birch, oak and willow), charred hazelnut shells, some burnt bone (at least some human), numerous artefacts including abundant Carinated Bowl, some fluted. Traces of *in situ* burning limited to patch *c.* 0.30 m across. Further spreads of burnt bone (at least some also human) at various levels in mound, central cist disturbed (A. Collins 1957; McAulay and Watts 1961). Interpreted by Alison Sheridan as cremation pyre (2003b)	5020±170		4240–3370	*4240–3615*

[1] Kytmannow (2008, table 7.3) states that this result was produced on a human femur from a young adult in cist A, citing Burenhult (1998) as her authority. This contradicts Burenhult (2001) who states that this sample is charcoal. In the light of these uncertainties, we have taken the conservative course and modelled this result as a *terminus post quem*.

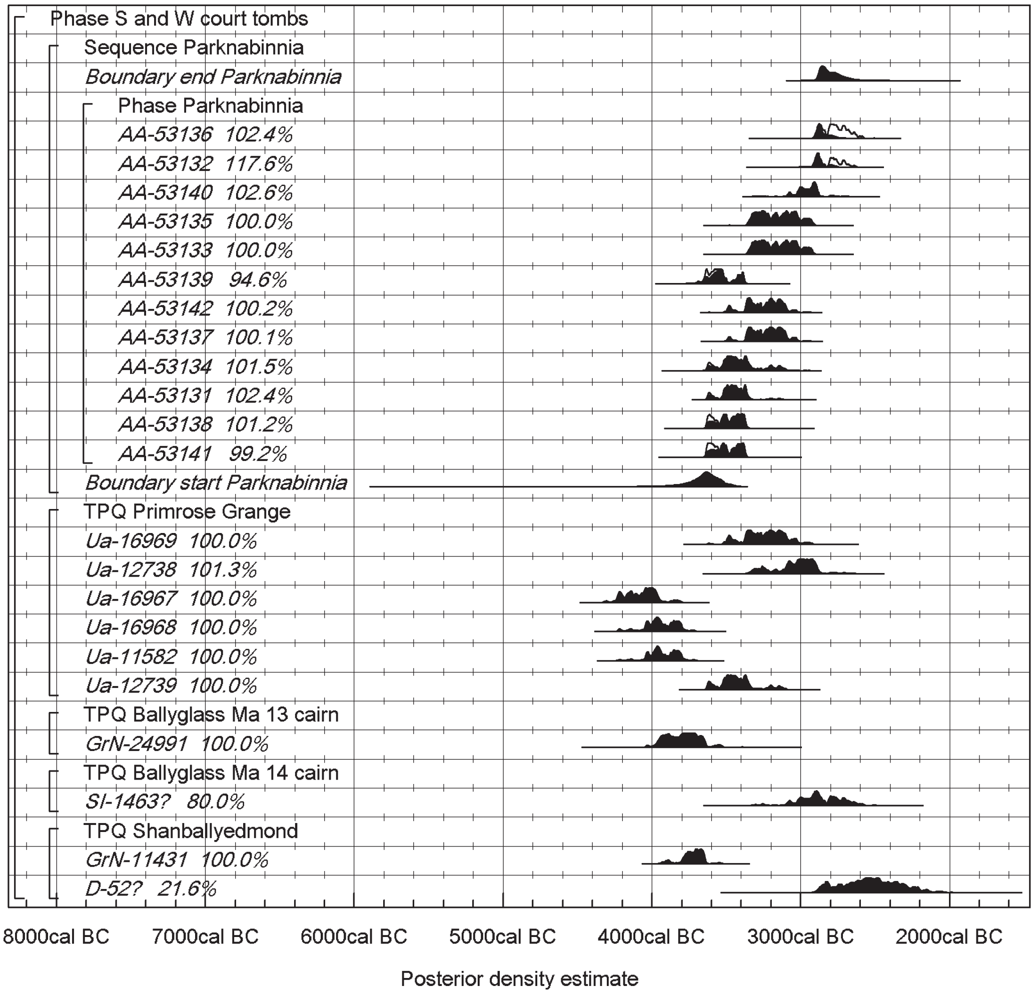

Fig. 12.33. Court tombs and related forms in southern and western Ireland. Probability distributions of dates. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.32 and its other component in Fig. 12.34.

tombs. In the chamber were the fragmented remains of at least 20 people, most of them inhumed, represented by 6084 identified bones including 25 articulating groups and one articulated group. All skeletal elements were present, but there was better preservation of the more robust bones, observations interpreted as reflecting primary inhumations disturbed in the course of successive interments (Beckett and Robb 2006, 62–3). Refits showed extensive and complex rearrangement (Beckett and Robb 2006, fig. 4.8). The piling up of bones in the front chamber against the blocking slabs separating it from the back chamber indicated that the back chamber had gone out of use first. In both chambers, the bottom layer of stone and bones seemed to stabilise the upright slabs and thus to have been part of the original construction (C. Jones 2004, 48). The earliest of the human remains might thus be close in age to the building of the tomb. Post-excavation analysis is still in progress, full contextual information is not yet available and, although each sample was a single bone, it is not yet clear whether each was from a separate individual and crucially whether any of the dated samples derive from articulated remains (see Chapter 2.5.2).

On the basis of the information available so far, we present a provisional model for the chronology of Parknabinnia, shown in Fig. 12.33. According to this, the monument was constructed in *3885–3440 cal BC* (*95% probability*; Fig. 12.33: *start Parknabinnia*), probably in *3715–3530 cal BC* (*68% probability*). The deposition of human remains continued until *2900–2640 cal BC* (*95% probability*; Fig. 12.33: *end Parknabinnia*), probably until *2880–2760 cal BC* (*68% probability*).

Another series of measurements come from a court tomb-like monument at Primrose Grange in Co. Sligo (Ó Nualláin 1989, 31), 2 km from the Carrowmore passage tomb cemetery, excavated in 1996–98 (Burenhult 2001; 2003). Like Parknabinnia, this had a bipartite chamber but lacked a court. According to the interim information available, its contents included predominantly inhumed, with very few cremated, bones together with chert leaf-shaped arrowheads. Six measurements were made (Table 12.5), five on unidentified charcoal and one on bone; although these are described as from the central chamber, their precise contexts are unknown (Burenhult 2001, 12; 2003, 68). At this stage, therefore, they can probably only

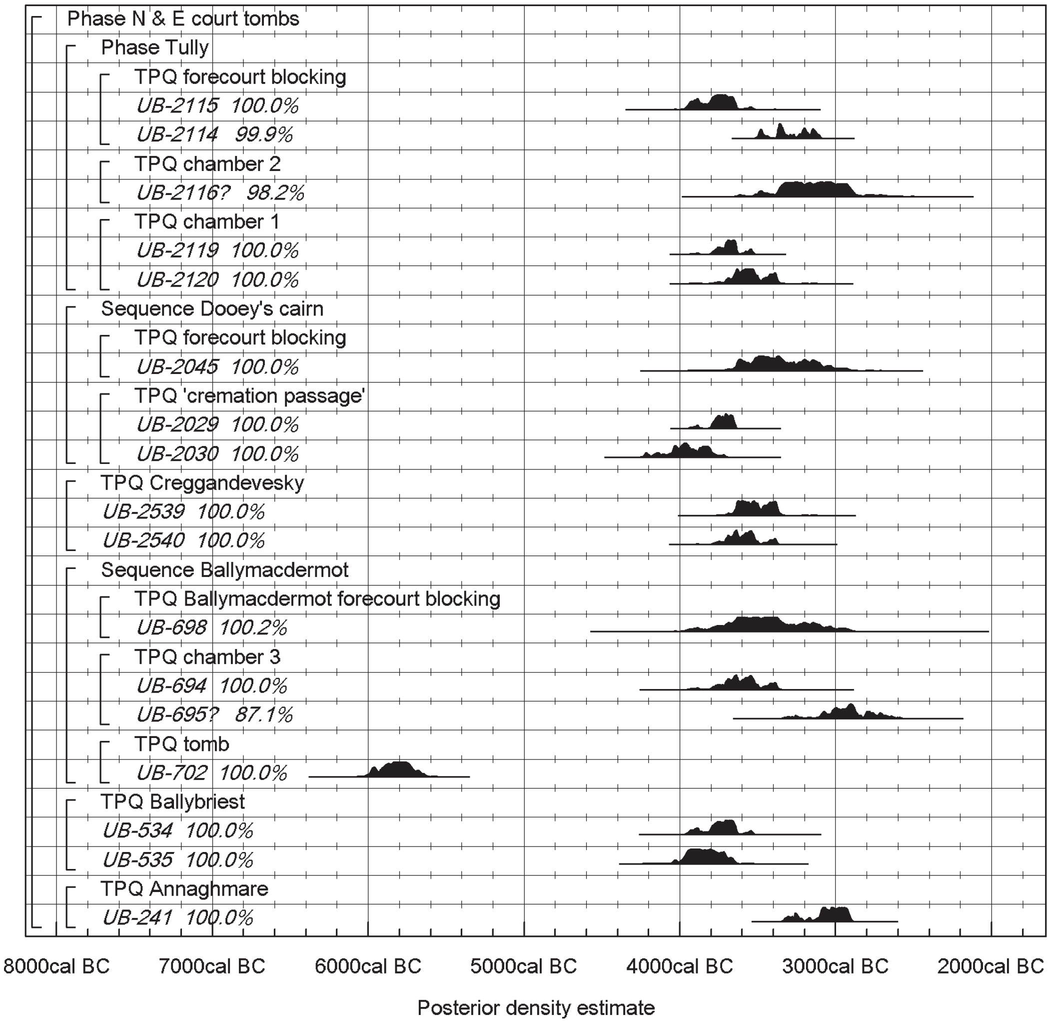

Fig. 12.34. Court tombs and related forms in northern and eastern Ireland. Probability distributions of dates. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.32 and its other component in Fig. 12.33.

be interpreted as providing *termini post quos* for the use of the chamber (Fig. 12.33).

A radiocarbon measurement (*GrN-24991*) was obtained on oak charcoal from an ash spread (F63) under the central court tomb at Ballyglass (Ma 13), close to the east wall of the underlying house (see above: Ó Nualláin 1972; Ó Nualláin *et al*. forthcoming). A large piece of struck chert and fragments of Carinated Bowl pottery were associated with this feature. The date is treated a *terminus post quem* for the construction of the tomb (Fig. 12.33), while the five Smithsonian dates for samples from the house which also pre-dated the tomb are not included in the model because they seem to be anomalously young, as discussed above. SI-1463, measured on unidentified charcoal from a dark layer immediately under the other court tomb nearby at Ballyglass (Ma 14; Ó Nualláin 1998), provides a *terminus post quem* for its construction but is excluded from the model for the same reason.

Two samples are available from the court tomb at Shanballyedmond, Co. Tipperary, excavated in 1958 (O'Kelly 1958; ApSimon 1986). A sample of unidentified charcoal bulked from a number of postholes surrounding the monument provides a *terminus post quem* for construction of 3930–3630 cal BC (95% confidence; Table 12.5: GrN-11431).[7] Another sample of unidentified charcoal described simply as from the chamber was dated (D-52), but appears anomalously young (McAulay and Watts 1961, 34), and so has been excluded from the model.

A court tomb at Annaghmare, Co. Armagh, with additional lateral chambers behind those entered from the court, was excavated in 1963–4 (Waterman 1965). A single sample of unidentified charcoal was dated and provides a *terminus post quem* for the primary blocking of the court and thus the disuse of the monument (Fig. 12.34: *UB-241*).[8]

A court tomb at Ballybriest, Co. Derry, was excavated in 1937 (E. Evans 1939). Two samples of unidentified charcoal were dated from a black layer containing early Neolithic material beneath the cairn of the monument. This deposit, however, was described as containing hazelnuts and hazel charcoal, so it is possible that these samples do not have a significant age offset. Strictly, however, they provide *termini post quos* for the construction of the monument and they have been incorporated in the model on that basis (Fig. 12.34: *UB-534–5*).

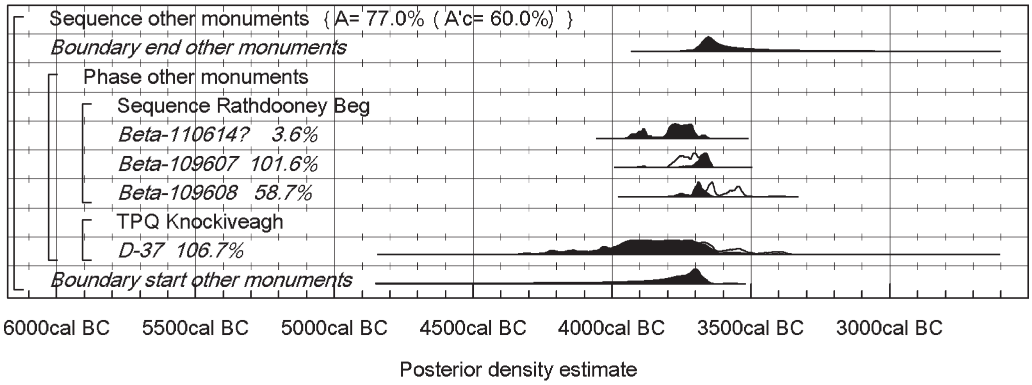

Fig. 12.35. Other monuments. Probability distributions of dates. The format is identical to that of Fig. 12.6. The large square brackets down the left-hand side, along with the OxCal keywords, define the overall model exactly.

A court tomb at Ballymacdermot, Co. Armagh, was excavated in 1962 (A. Collins and Wilson 1964). Ten samples of unidentified charcoal were dated (Table 12.5). *UB-702* provides a *terminus post quem* for the building of the cairn, although the sample clearly derived from earlier activity (Fig. 12.34). Two samples (*UB-694*, -695) come from layers relating to the use of chamber 3. They therefore provide *termini post quos* for the end of the primary use of this chamber. UB-695, however, has been excluded from the model because it may have included intrusive charcoal (A. Smith *et al*. 1974). *UB-698* provides a *terminus post quem* for the blocking of the forecourt (Fig. 12.34), although this does not appear to have occurred until the Bronze Age (UB-207, -705), and material appears to have been deposited in the chambers in the Viking period (UB-693, -697, -700, -703). There was clearly much post-Neolithic use and disturbance of the monument.

A court tomb at Creggandevesky, Co. Tyrone, was excavated in 1977 (Foley 1988; Sheridan 1995). Two radiocarbon determinations on unidentified bulk charcoal are available (Table 12.5: *UB-2539, -2540*). Both samples are from within the chamber, from a context associated with Carinated Bowl pottery. In advance of full publication, these dates have been included in the model as *termini post quos* for the end of the primary Neolithic use of the monument (Fig. 12.34).

A court tomb (Dooey's Cairn) at Ballymacaldrack, Co. Antrim, was excavated in 1935 and 1975 (E. Evans 1938; A. Collins 1976). It provides the only definite example of a timber mortuary structure in Ireland (Sheridan 2006a, 27) followed by a stone cremation passage and then one of the best sequences for the construction and development of a court tomb, and a rich assemblage of Neolithic finds (A. Collins 1976; Herity 1987; Cooney 2000a, fig. 4.3). Only three radiocarbon determinations are available. A sample of oak charcoal (*UB-2029*) may provide a *terminus post quem* for the construction of the stone cremation passage (Phase II: Cooney 2000a, fig. 4.3), and a sample of unidentified charcoal (*UB-2030*) may do likewise. A third sample (*UB-2045*) of unidentified charcoal provides a *terminus post quem* for the final blocking of the forecourt (Phase IV) (Fig. 12.34).

A court tomb at Tully, Co. Fermanagh, was excavated in 1976 (Waterman 1978). Five dates were obtained on bulk samples of unidentified charcoal. Two samples from chamber 1 provide *termini post quos* for its disuse (*UB-2119–20*). A date from a similar deposit in chamber 2 (UB-2116) has been excluded from the model, since it contained charcoal that was not sealed by the stone filling and may be intrusive (Waterman 1978, 12). Two samples provide *termini post quos* for the blocking of the forecourt (Fig. 12.34: *UB-2114–5*).

Further series of radiocarbon dates from the court tombs at Behy and Rathlackan, Co. Mayo, two results from Aghanaglack, Co. Fermanagh, and single dates from two further sites reported by Kytmannow (2008, table 7.3), appeared after the modelling here was completed but do not substantially alter our date estimates for the currency of court tombs.[9]

Round mounds

At Rathdooney Beg, Co. Sligo, some 17 km south of Magheraboy, a section was cut across the ditch surrounding an otherwise uninvestigated, slightly ovoid mound surviving to 6.1 m high and with a maximum dimension of 24.5 m (Mount 1999). The mound was sited on a drumlin, affording views of Sligo Bay and the surrounding landscape. Pollen from throughout the dated layers reflected grassland, with indicators of disturbed, bare ground confined to the base of the sequence, suggesting that clearance immediately preceded mound building. Low levels of cereal-type pollen were present throughout. Tree pollen did not exceed 15%, although the small area of the ditch probably means that these results relate to the vegetation of the hilltop and that the wider area was more heavily wooded (Weir 1999).

The lower fills of the ditch consisted of clays which had remained waterlogged. Charcoal was present in all three layers. The basal fill of the ditch (context 118) preserved seeds of wild plants, dated by *Beta-109608* (Fig. 12.35). The overlying layer (context 117) contained badly preserved animal bone including a cattle humerus fragment, hazel and willow rods, insect remains, molluscs, and further seeds of wild plants, dated by *Beta-109607*. The clay above

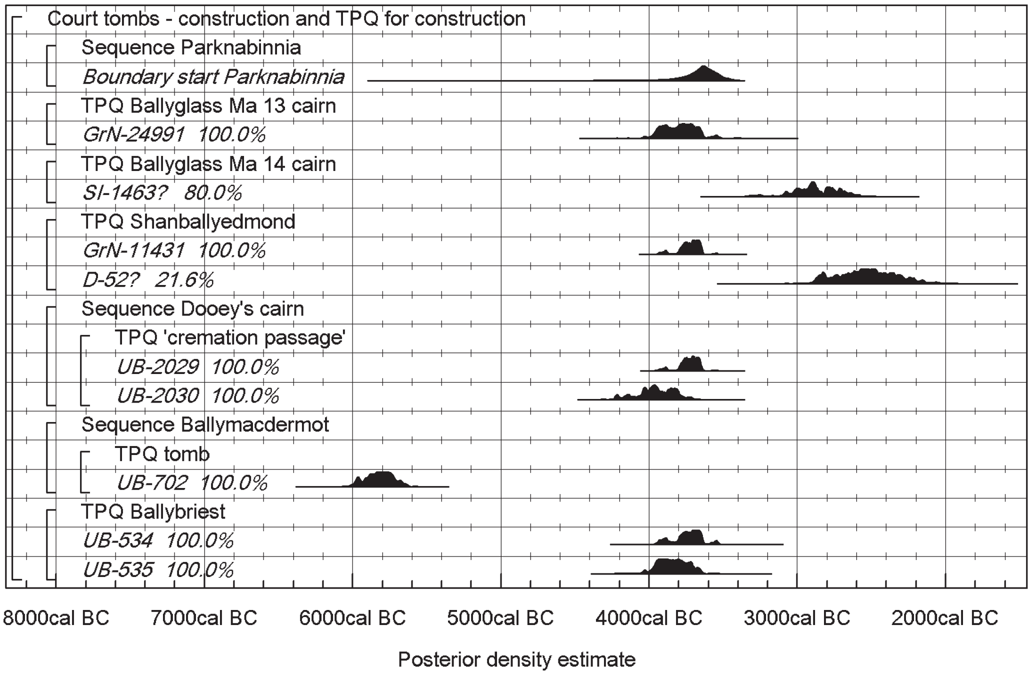

Fig. 12.36. Court tombs and related forms. Key parameters for dates relating to construction, derived from the chronological model defined in Figs 12.32–4. All dates provide termini post quos for construction, except the estimate from Parknabinnia.

this (context 116) was confined to the inner edge of the ditch, and had probably eroded from the mound. It too contained hazel and willow rods, as well as charcoal, animal bone including goose limb fragments, and further seeds of wild plants, dated by Beta-110614. The measurements are statistically consistent (T'=5.5; T'(5%)= 6.0; ν=2). Given that turf may have formed on the surface of context 118 (Mount 1999, 342), this sequence may have taken some time to accumulate, so that the sample for Beta-110614 may well have formed part of the mound before silting into the ditch. For this reason, we have interpreted the material for Beta-110614 as redeposited, and it has been excluded from the model. On the basis of the basal sample, we estimate that the monument was constructed in *3775–3645 cal BC* (*95% probability*; Fig. 12.35: *Beta-109608*), probably in *3710–3660 cal BC* (*68% probability*).

A round mound containing a central cist at Knockiveagh, Co. Down, was excavated in 1956. It was built over a soil containing much charcoal, numerous artefacts including Carinated Bowl sherds, and cremated bone, some of it human (A. Collins 1957), a deposit interpreted as a cremation pyre (Sheridan 2003b; 2006a). An unidentified bulk charcoal sample provides a *terminus post quem* for the construction of the mound (Fig. 12.35; Table 12.5: *D-37*; McAulay and Watts 1961).

It is clear from the models shown in Figs 12.31–5 that our understanding of the chronology of early Neolithic megalithic tombs in Ireland is sadly inadequate. Of the portal tombs, at the time of modelling only Poulnabrone had radiocarbon dates, and until further analysis and publication of that assemblage are undertaken it is unclear how its dates should be interpreted. They can be read to suggest that the orthostats at Poulnabrone were raised in the first quarter of the fourth millennium cal BC, or alternatively that they were raised in the centuries around 3000 cal BC (an interpretation that we feel more plausible on the available evidence). All we can say for certain at present is that the mortuary deposit was placed in the monument sometime within the fourth millennium cal BC.[10]

Our understanding of the chronology of court tombs, based on their radiocarbon dating, is even more depressing (Fig. 12.36). Thirty-nine radiocarbon dates are available, all of which only provide *termini post quos* for the contexts from which they were recovered, except for the series of dates on human bone from Parknabinnia. Only samples from Ballyglass Ma 13 (*GrN-24991*), Ballyglass Ma 14 (SI-1463, considered unreliable on scientific grounds), Shanballyedmond (*GrN-11431*, and D-52, also considered unreliable on scientific grounds), Dooey's Cairn (*UB-2029–30*), Ballymacdermot (*UB-702*) and Ballybriest (*UB-534–5*) seem to provide *termini post quos* for construction of the monuments. All the other dates provide only *termini post quos* either for the final use of the chambers or for the blocking of their forecourts.[11]

Preliminary analysis of the series of dates from Parknabinnia suggests, more positively, that this monument may have been constructed in the second quarter of the fourth millennium cal BC (Fig. 12.33: *start Parknabinnia*). The available *termini post quos* for the construction of other court tombs, though the sample is small, as shown in Fig. 12.36, do not contradict the inference that this kind of monument may have been built in the first half of the fourth millennium cal BC, and the dates shown in Fig. 12.36 are also not inconsistent with the possibility of a shorter horizon of construction within that time period. Although court tombs are contexts which may have remained open

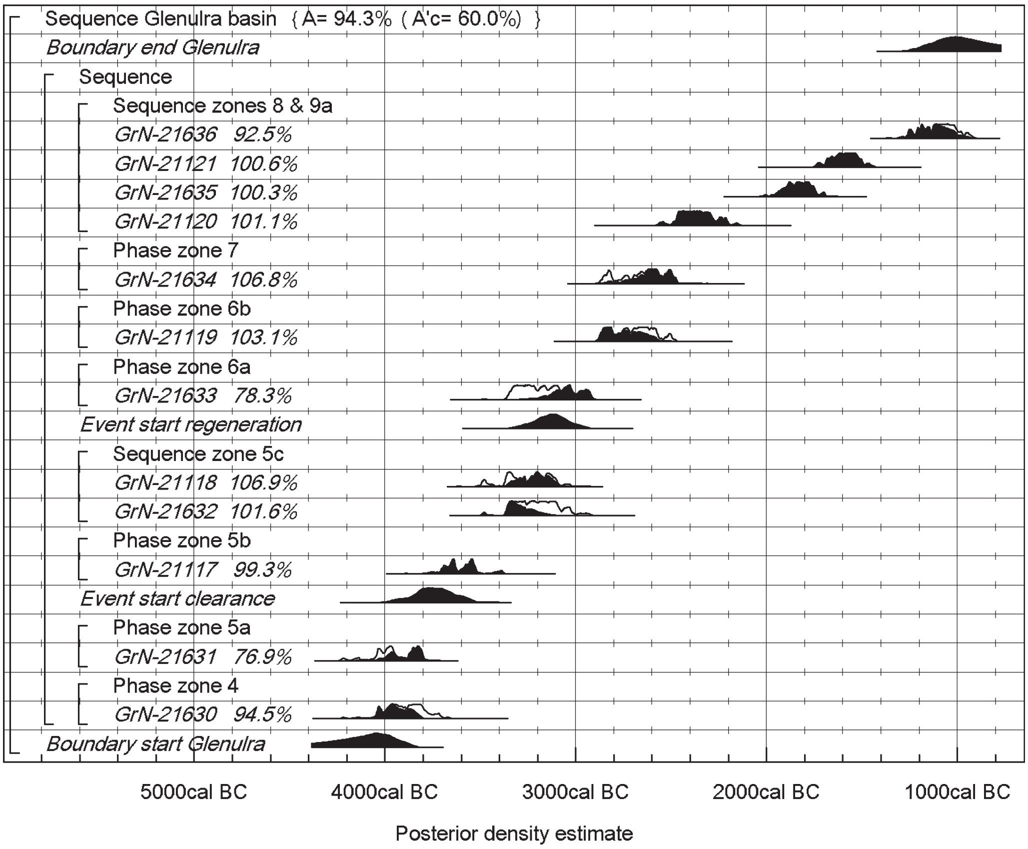

Fig. 12.37. Céide Fields. Probability distributions of dates from the deep peat sequence in the Glenulra basin. The format is identical to that of Fig. 12.6. The large square brackets down the left-hand side, along with the OxCal keywords, define the overall model exactly.

for many centuries, demonstrably into the Bronze Age and even the Viking period (as at Ballymacdermot), in general the blocking of forecourts and the end of primary use appear to have occurred in or before the first quarter of the third millennium cal BC. Some tombs may have remained in use for relatively short periods of time.

The two round mounds which we have considered, Rathdooney Beg and Knockiveagh (Fig. 12.35), may also date to the second quarter of the fourth millennium cal BC. The potential for providing further reliable suites of measurements, which might confirm or contradict the tentative suggestions for the chronology of court tombs given here, is good. The now routine availability of AMS and new methods for dating cremated bone should allow existing archives to be mined for short-life samples associated with the construction and primary use of these monuments. A start has now been made on this task with a series of new measurements on human and animal bone from court tombs (Rick Schulting, pers. comm.).

Field systems

Stone-built field walls extend intermittently for some 50 km along the north Mayo coast, where the best known system is the Céide Fields, investigated over many seasons from the 1970s to the 1990s by Seamas Caulfield. They are preserved beneath blanket bog which began to grow after they had ceased to be built, since, where the walls have been excavated, they generally stand on mineral soil, without intervening peat (Caulfield 1978; Molloy and O'Connell 1995). The few artefacts that have been recovered are Neolithic (Byrne 1991; Caulfield 1978). Settlement enclosures lie among the fields, in the case of the western part of the Céide Fields forming an irregular line two or three fields inland from the northern, coastal edge of the system (Cooney 2000a, 28). Court and portal tombs, of which there is a major concentration locally, also lie within and close to the fields (Caulfield 1983, fig. 1). One court tomb, at Behy, is abutted and post-dated by a wall (de Valera and Ó Nualláin 1964, 4–6), which forms part of an enclosure surrounding the tomb and occupying the junction of four field walls (Caulfield 1978, fig. 19.1). This does not mean that the fields post-date the tomb, since the enclosure, which is not aligned with the others in the area, post-dates the field walls (Caulfield 1978, 141). The way in which the field walls converge on the tomb, however, strongly suggests that it was already present when they were laid out.

Ten kilometres east of the Céide Fields and separated from them by the valley of the Ballinglen River is another complex of field and tombs at Rathlackan. A court tomb within the fields here pre-dated a small enclosure, which was itself independent of the field walls (Byrne 1990; 1992; 1993).

The dating of the north Mayo fields is bound up with that of local vegetation change and peat growth. Neither history need be uniform over so large an area, but certain patterns emerge. In the 1970s, a measurement on unidentified charcoal from a hearth in one of the settlement enclosures at Glenulra in the Céide Fields provided a *terminus post quem* for the settlement and for the start of peat growth in the later fourth or early third millennium cal BC (Table 12.6: SI-1464). This impression was reinforced by an early third millennium cal BC date for the outer five rings of a pine stump estimated to have been about 100 years old at death, within further fields at Belderg Beg to the west. This tree must have started growing after some peat had formed, since its lateral roots ran along the surface of mineral soil (Table 12.6: SI-1470; Caulfield 1978, 141). Consistent with this time scale was a third millennium cal BC date for peat from near the base of a monolith taken from close to the Behy court tomb (Fig. 12.38; Table 12.6: *UB-158F*; A. Smith *et al.* 1973, 223). Given the possibility that radiocarbon ages measured by the Smithsonian Institution at this time may have been anomalously young (see above), this chronology may now be in doubt.

In the early 1990s palynological analysis of deposits from a deep basin at Glenulra, close to the Céide Fields, where peat had begun to accumulate early in the Holocene, provided a vegetation record extending to the early medieval period (Molloy and O'Connell 1995; O'Connell and Molloy 2001). A series of conventional radiocarbon determinations were provided by the Rijksuniversiteit Groningen on the acid- and alkali-insoluble residue of bulk peat samples (Table 12.6). These were pretreated as described by Mook and Waterbolk (1985) and dated by GPC of carbon dioxide as described by Mook and Streurman (1983). The first significant event here is an episode of woodland burning and soil erosion, without obvious diminution of woodland cover, in local pollen zone 4, a peat sample from which has been dated to the early fourth millennium cal BC (*4070–3805 cal BC*; *95% probability*; Fig. 12.37: *GrN-21630*; or *4040–4015 cal BC* (*9% probability*) or *3995–3890 cal BC* (*47% probability*) or *3885–3850 cal BC* (*12% probability*)).

The second event is major forest clearance accompanied by the development of herb-rich grassland, beginning in local pollen zone 5a and reaching its peak in zone 5b. Grasses and herbs continued to be represented to the end of zone 5c, alongside regenerating mixed tree cover. This period can be modelled as starting in *3960–3540 cal BC* (*95% probability*; Fig. 12.37: *start clearance*), probably in *3845–3635 cal BC* (*68% probability*), and ending in *3300–2960 cal BC* (*95% probability*; Fig. 12.37: *start regeneration*), probably in *3210–3040 cal BC* (*68% probability*). The difference between these two date estimates suggests that the major clearance episode lasted for *335–880 years* (*95% probability*; distribution not shown), probably *475–745 years* (*68% probability*). After this, grasses and herbs fell to a low level, tree cover, including prominently pine in subzone 6b, regenerated, and bog and heath species increased. The authors interpret this sequence as resulting from a period of pastoral farming, at its most intensive in zone 5b. Following Caulfield's view that the field system was laid out as a single entity, which could have been done only in open conditions (1983), they conclude that the fields were laid out during zone 5b. They argued that there was no necessary link between the abandonment of the fields and the spread of blanket bog, which may have been separated by some time. Abandonment may have coincided with a period of unstable climate and increasing storminess, as argued by C. Caseldine *et al*. (2005) and Verrill (2006); the potential links between climate change and Neolithic agriculture in this region are currently being re-assessed (Graeme Warren, pers. comm.).

In the course of the same investigation, dates for peat from five of seven short monoliths taken from within the Céide Fields themselves provided further indications of when peat growth had extended beyond the basin, thus providing a series of *termini ante quos* for the disuse of the fields and supplementing work already done (A. Smith *et al*. 1973, 223). In the area of the Behy court tomb, peat did not begin to grow until the mid-third millennium cal BC. A sequence of two radiocarbon measurements obtained in the 1970s on the fine particulate fraction of peat from a core close to the tomb itself is in good agreement with the stratigraphy (Fig. 12.38: *UB-153F, -158F*). The radiocarbon ages obtained from the humic acid fraction of this material (Table 12.6: UB-158C, -153C, -155) appear to be anomalously young (A. Smith *et al.* 1973, 223) and are not included in the model.

Profile BHY III, 60 m west of the Behy court tomb, produced a series of seven radiocarbon dates (Table 12.6; Molloy and O'Connell 1995). Two samples have replicate determinations, in both cases statistically consistent (Table 12.6: GrN-23497 and Gd-6693; Gd-7147 and -7148). All the samples consisted of the acid- and alkali- insoluble residue of bulk peat samples and were dated by GPC of carbon dioxide (Mook and Streurman 1983; Pazdur and Pazdur 1986). Two measurements are also available for each of three further peat sections around the court tomb (Table 12.6: BHY IV, V and VI). In each case the dates are in good agreement with the stratigraphic sequence (Fig. 12.38). To the north, in the area of the Visitor Centre, peat growth did not begin until the turn of the second and first millennia (Table 12.6*:* GrN-20631).

Also in the 1990s, radiocarbon dates were obtained for 29 pine stumps growing in the peat over and around the field walls at Céide Fields as well as for a peat sample from beneath one of the stumps; and for further stumps and a further peat sample from the Erris region to the west (Caulfield *et al.* 1998). Those which relate to the fields are shown in Fig. 12.39. The trees are unlikely to have age offsets of more than 100 years, if reliance is placed on dendrochronological investigation of a group of pine stumps 200 m from the archaeological site at Belderg Beg, which established that the lifespan of the individual trees was *c.* 100 years (Caulfield 1988; Molloy and O'Connell 1995, 194). Most were rooted in peat, and can have grown

Table 12.6. Radiocarbon dates relating to field walls in Ireland. Posterior density estimates derive from the models defined in Figs 12.37–9.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Céide Fields, Co. Mayo: Glenulra pollen core								
GrN-21636	GLU IV-12	Peat	2.55–2.58 m from surface. Zone 9a (top). Tree pollen low, grasses and herbs briefly high, following rise in hazel and alder between GrN-21121 and this	2890±50	−28.0		1260–920	*1270–970*
GrN-21121	GLU IV-5	Peat	2.89–2.93 m from surface. Zone 8/zone 9a boundary. Pine falling, total tree pollen low, grasses and herbs briefly high	3310±60	−27.8		1750–1440	*1740–1705 (4%)* or *1700–1450 (91%)*
GrN-21635	GLU IV-11	Peat	3.19–3.22 m from surface. Zone 8. Grasses high, tree and scrub species fairly low, moorland species fairly constant (Molloy and O'Connell 1995, fig. 6)	3510±50	−27.4		1960–1690	*1965–1725 (92%)* or *1720–1690 (3%)*
GrN-21120	GLU IV-4	Peat	3.51–3.55 m from surface. Base of zone 8. Grasses increasing, tree and scrub species decreasing (Molloy and O'Connell 1995, fig. 6)	3890±60	−27.0		2570–2150	*2550–2535 (1%)* or *2495–2195 (94%)*
GrN-21634	GLU IV-10	Peat	3.87–3.90 m from surface. Zone 7. Pine falling, other tree species and moorland species increasing, grass low (Molloy and O'Connell 1995, fig. 6)	4070±60	−27.8		2880–2460	*2835–2810 (1%)* or *2755–2465 (94%)*
GrN-21119	GLU IV-3	Peat	4.02–4.06 m. Zone 6b. Grass pollen low, pine peak, scrub and moorland species declining (Molloy and O'Connell 1995, fig. 6)	4110±60	−28.0		2890–2480	*2880–2580*
GrN-21633	GLU IV-9	Peat	4.40–4.44 m from surface Zone 6a. Grass pollen low; pine, scrub and moorland species spreading; developing moorland with pine spreading (Molloy and O'Connell 1995, fig. 6)	4470±60	−28.1		3370–2910	*3195–2910*
GrN-21118	GLU IV-2	Peat	4.48–4.52 m from surface. Zone 5c. Falling but still high levels of grass pollen accompanied by some woodland regeneration (Molloy and O'Connell 1995, fig. 6)	4550±60	−27.6		3500–3020	*3355–3095*
GrN-21632	GLU IV-8	Peat	4.59–4.62 m from surface. Zone 5c. Falling but still high levels of grass pollen accompanied by some woodland regeneration (Molloy and O'Connell 1995, fig. 6)	4500±60	−26.9		3370–2930	*3495–3465 (3%)* or *3375–3145 (92%)*
GrN-21117	GLU IV-1	Peat	4.86–4.90 m from surface. Base of zone 5b. Major decrease in pine and other arboreal pollen and increase in grass (Molloy and O'Connell 1995, fig. 6)	4840±60	−28.2		3710–3510	*3715–3500 (89%)* or *3430–3375 (6%)*
GrN-21631	GLU IV-7	Peat	4.94–4.97 m from surface. Zone 5a. Post-elm decline, clearance beginning (Molloy and O'Connell 1995, fig. 6)	5170±60	−27.5		4230–3800	*4030–3790*
GrN-21630	GLU IV-6	Peat	5.15–5.18 m from surface. Zone 4. Pre-elm decline, largely wooded, pine decreasing, oak and hazel increasing (Molloy and O'Connell 1995, fig. 6)	5100±80	−28.5		4050–3700	*4070–3805*
Céide Fields, Co. Mayo: peat beside Behy court tomb								
UB-158F		Fine particulate fraction of peat	0.36–0.38 m (A. Smith *et al.* 1973, 223)	3930±105	−29.1		2860–2130	*2840–2810 (1%)* or *2700–2200 (94%)*
UB-158C		Humic acid fraction peat	0.36–0.38 m 'difference between fine-particulate and humic acid fractions of UB-153 indicates considerable movement of humic substances in profile' (A. Smith *et al.* 1973, 223)	3750±85	−28.0		2470–1920	
UB-155		Combined fine particulate and humic acid fractions of blanket peat	0.30–0.34 m 'difference between fine-particulate and humic acid fractions of UB-153 indicates considerable movement of humic substances in profile. Result from combined sample, UB-155, is therefore, possibly largely erroneous' (A. Smith *et al.* 1973, 223)	3630±70	−27.5		2130–1770	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
UB-153F		Fine particulate fraction of peat	0.24–0.28 m (A. Smith *et al.* 1973)	3890±110			2840–2030	*2565–2115* (*92%*) or *2095–2040* (*3%*)
UB-153C		Humic acid fraction of peat	0.24–0.28 m (A. Smith *et al.* 1973)	3245±70	−27.4		1690–1390	
Céide Fields, Co. Mayo: profile BHY III, 60 m W of Behy court tomb								
GrN-23497		Peat	0.01–0.00 m above base of peat. Start of peat accumulation, grasses declining, pine, other trees and heather beginning to increase (Molloy and O'Connell 1995; O'Connell and Molloy 2001)	4110±40	−29.2	4094±36 T'=0.8; T'(5%)=3.8; ν=1	2870–2490	*2860–2805* (*12%*) or *2760–2715* (*8%*) or *2710–2560* (*67%*) or *2535–2490* (*8%*)
Gd-6693	BHY III-1	Replicate of GrN-232497	As GrN-23497	4030±80	−25.0 (assumed)			
GrN-23498		Peat	0.06–0.05 m above base of peat. Pine and heather declining, birch increasing	3870±25	−29.3		2470–2210	*2465–2280* (*93%*) or *2250–2230* (*2%*)
Gd-7147	BHY III-2	Peat	0.07 to 0.06 m above base of peat. Birch dominant	3360±50	−25.0 (assumed)	3332±38 T'=1.0; T'(5%)=3.8; ν=1	1730–1510	*1735–1710* (*4%*) or *1695–1530* (*91%*)
Gd-7148	BHY III-2	Replicate of Gd-7147	As Gd-7147	3290±60	−25.0 (assumed)			
GrN-20031	BHY III (5)	Peat	0.14–0.16 m above base of peat. Grasses dominant	3290±30	−29.0		1640–1490	*1625–1495*
GrN-23499		Peat	0.165–0.175 m above base of peat. Grasses dominant	3090±30	−29.4		1430–1270	*1435–1290*
Céide Fields, Co. Mayo: profile BHY IV, 25 m N of Behy court tomb								
GrN-20029	BHY IV(3)	Peat	0.01–0.04 m above base of peat. Much tree cover (Molloy and O'Connell 1995, fig. 11)	3630±40	−29.4		2140–1880	*2135–2080* (*12%*) or *2060–1885* (*83%*)
GrN-20030	BHY IV(4)	Peat	0.07–0.10 above base of peat. Mainly grasses and herbs (Molloy and O'Connell 1995, fig. 11)	2940±40	−29.4		1300–1010	*1300–1025*
Céide Fields, Co. Mayo: profile BHY V, peat bank 35 m E of Behy Court tomb								
Gd-6694	BHY V-1	Peat	0–0.01 m below base of peat. Woodland, especially birch, some grasses and plants of bog and heath	3990±80	−25.0 (assumed)		2860–2280	*2855–2810* (*3%*) or *2750–2720* (*1%*) or *2700–2275* (*88%*) or *2255–2205* (*3%*)
Gd-6696	BHY V-2	Peat	0.70 m to 0.85 m above base of peat. Grasses and plants of bog and heath (Molloy and O'Connell 1995, fig. 13)	3450±80	−25.0 (assumed)		1960–1530	*2020–1995* (*1%*) or *1980–1600* (*94%*)
Céide Fields, Co. Mayo: profile BHY VI, *c.* 400 m NW of Behy court tomb								
GrN-20027	BHY VI (1)	Peat	0.05–0.08 m above base of peat. Pine, birch and other trees declining, grasses and plants of bog and heath increasing heath (Molloy and O'Connell 1995, fig. 14)	4080±50	−29.3		2880–2470	*2865–2805* (*12%*) or *2760–2475* (*83%*)
GrN-20028	BHY VI (2)	Peat	0.10–0.13 above base of peat. Grasses and plants of bog and heath dominant (Molloy and O'Connell 1995, fig. 14)	3540±50	−29.1		2030–1740	*2025–1990* (*5%*) or *1985–1745* (*90%*)
Céide Fields, Co. Mayo: monolith CFI, 30 m SW of visitor centre								
GrN-20631	CF I-1	Peat	0–0.01 m above base of peat, under tumble from wall. Grasses and plants of bog and heath dominant (Molloy and O'Connell 1995, figs 17, 18)	2760±40	−28.2		1010–810	
GrN-21116	CF-I-3	Peat	0.01–0.02 m above base of peat. Grasses and plants of bog and heath dominant (Molloy and O'Connell 1995, figs 17, 18)	2870±40	−29.3		1200–910	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrN-20632	CF-I-2	Peat	0.07–0.08 m above base of peat. Grasses and plants of bog and heath dominant (Molloy and O'Connell 1995, figs 17, 18)	2250±50	−28.9		410–190	
Céide Fields, Co. Mayo: Glenulra								
SI-1464		Charcoal	Hearth within the Glenulra enclosure (Caulfield 1978) Quoted as 4460±80 by Caulfield *et al*. (1998)	4460±115			3510–2880	
UCD-C45	G-050-404	Sub-fossil *Pinus sylvestris* stump	Growing on mineral soil at Behy, 1 m from wall of field system	4450±60			3360–2910	*3340–3000 (84%)* or *2995–2925 (11%)*
UCD-C51	G-050-404	Outer rings of sub-fossil *Pinus sylvestris* stump	Lying horizontally in bog which had grown over field system at Behy, near tomb, 0.05 m above mineral soil	4500±60			3370–2930	*3365–3010*
UCD-C57	G-047-405	Sub-fossil *Pinus sylvestris*. Outer remnant of very large trunk	Lying on mineral soil at Behy, 65 m W of tomb	4420±50			3340–2900	*3330–3210 (22%)* or *3190–3150 (5%)* or *3135–2910 (68%)*
UCD-C42	G-063-399	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Glenulra, 0.90 m above mineral soil, near edge of deep peat basin from which pollen core taken	4530±60			3500–3020	
UCD-C44	G-063-399	Sub-fossil *Pinus sylvestris* stump	At base of peat which had grown over peat at Glenulra, near edge of deep peat basin from which pollen core taken and in agreement with date for peat at just over 5 m in pollen core, where burnt pine fragments found	5370±70			4350–3990	
Céide Fields, Co. Mayo: Ballyknock								
UCD-C21	G-076-387	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system, at Ballyknock, 0.10 m above mineral soil	4490±60			3370–2920	*3365–3010 (94%)* or *2980–2960 (1%)*
UCD-C23	G-072-382	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Ballyknock, 0.75 m above mineral soil	4540±60			3500–3020	*3375–3080 (92%)* or *3065–3025 (3%)*
UCD-C28	G-072-382	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Ballyknock, 0.20 m above mineral soil	4230±60			2930–2630	*3010–2985 (1%)* or *2935–2615 (94%)*
UCD-C29	G-072-382	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Ballyknock, 0.30 m above mineral soil	4510±50			3370–3020	*3360–3085 (91%)* or *3065–3025 (4%)*
UCD-C34	G-073-382	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Ballyknock, 0.35 m above mineral soil	3950±60			2620–2280	*2590–2275 (94%)* or *2250–2230 (1%)*
UCD-C37	G-074-383	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Ballyknock, 0.30 m above mineral soil	4500±50			3370–3020	*3360–3080 (89%)* or *3070–3025 (6%)*
Céide Fields, Co. Mayo: Aghoo								
UCD-C22	G-086-354	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Aghoo, 0.25m above mineral soil	4210±60			2920–2610	*2920–2615*
UCD-C27	G-092-360	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Aghoo, 0.25m above mineral soil	4170±50			2900–2570	*2890–2615*
UCD-C30	G-089-357	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Aghoo, 0.20m above mineral soil	4190±50			2910–2600	*2900–2620*
UCD-C33	G-089-357	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Aghoo, 0.30 m above mineral soil	4100±60			2880–2470	*2875–2560 (88%)* or *2540–2490 (7%)*
Céide Fields, Co. Mayo: Belderg								
SI-1469	Belderg Beg 1	*Quercus* stump	Growing in peat E of site at Belderg Beg	3835±85			2570–2030	

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**δ^{13}C (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
SI-1470	Belderg Beg 2	Outer 5 rings of large pine stump	15 m from wall at Belderg Beg. Lateral roots running along surface of mineral soil, i.e. bog already established when tree growing	4220±95			3080–2490	
SI-1471	Belderg Beg 3	Pointed *Quercus* stake	Driven into peat prolonging line of wall built on shallow encroaching peat	3220±85			1690–1310	
SI-1472	Belderg Beg 4	Pointed *Quercus* stake	Driven into peat prolonging line of wall built on shallow encroaching peat	3210±85			1690–1300	
SI-1473	Belderg Beg 5	Block of wood	In roundhouse	3170±85			1630–1260	
SI-1474	Belderg Beg 6	Charcoal	In roundhouse, 'impossible to reconcile with either the archaeological material or the radiocarbon dates from the site' (Caulfield 1978, 142)	2295±75			540–180	
SI-1475	Belderg Beg 7	Charcoal	Associated with scatter of flint scrapers 'impossible to reconcile with either the archaeological material or the radiocarbon dates from the site' (Caulfield 1978, 142)	2905±75			1380–900	
UCD-C04	F-997-412	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Belderg More, 0.30m above mineral soil and 2 m from a wall	4480±60			3370–2920	*3355–3005 (92%)* or *2980–2935 (3%)*
UCD-C11	G-008-408	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Belderg More, 0.50m above mineral soil and 55 m from a wall junction	4010±60			2840–2340	*2860–2810 (5%)* or *2750–2720 (1%)* or *2700–2340 (89%)*
UCD-C14	G-013-409	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Belderg More, 0.25m above mineral soil	4310±70			3100–2710	*3265–3235 (1%)* or *3110–2835 (84%)* or *2815–2690 (10%)*
UCD-C18	F-997-413	Sub-fossil *Pinus sylvestris* stump	In mineral soil 30 m E of a wall junction at Belderg More	4150±60			2900–2490	*2890–2575*
UCD-C49	F997-412	Sub-fossil *Pinus sylvestris* stump	Rooted in wall of field system at Belderg More, 9m south of wall junction close to UCD-C18	4580±60			3520–3090	*3495–3430 (4%)* or *3385–3085 (91%)*
UCD-C07	F-976-402	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Belderg Beg, 0.70m above mineral soil	3330±50			1750–1490	*1880–1840 (7%)* or *1770–1525 (88%)*
UCD-C31	F-984-406	Sub-fossil *Pinus sylvestris* stump	Growing at base of bog which had grown over field system at Belderg Beg	4510±50			3370–3020	*3360–3085 (91%)* or *3065–3025 (4%)*
UCD-C58	F-975-402	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Belderg Beg, 0.75m above mineral soil	3960±60			2620–2280	*2625–2280*
UCD-C60	F-985-405	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Belderg Beg, unknown distance above mineral soil	3930±50			2570–2240	*2575–2510 (11%)* or *2505–2285 (83%)* or *2250–2230 (1%)*
UCD-C47	F-983-409	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Geevraun, 0.45m above mineral soil and above sample for UCD-C46	4210±60			2920–2610	
UCD-C46	F-983-409	Peat	From bog which had grown over field system at Geevraun, on low ridge, 0.05m above mineral soil and below sample for UCD-C47	5710±90			3270–2880	
Excavations at Belderg, Co. Mayo, 2004–ongoing								
UB-7590		*Corylus* charcoal, Twig	BDG context 115. Hearth sealed by 'tumble' from a pre-bog field wall (Warren 2007)	4780±36	−23.1		3650–3380	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
UB-7591		*Betula* charcoal, twig	From the same context as UB-7590	4717±37	−23.1	4726±24	3635–3380	
UBA-7591		Replicate of UB-7591	From the same context as UB-7590	4732±30		T'=0.1 T'(5%)=3.8; ν=1		
Céide Fields, Co. Mayo: Annagh More/Annagh Beg								
UCD-C26	G-115-343	Sub-fossil *Pinus sylvestris* stump	Growing on wall of field system in bog which had grown over it at Annagh More	4350±60			3270–2880	*3320–3290* (*1%*) or *3270–3235* (*3%*) or *3120–2875* (*91%*)
UCD-C50	G-115-343	Sub-fossil *Pinus sylvestris* stump	Rooted in mineral in mineral soil close to peat-covered field wall at Annagh More (Caulfield *et al.* 1998, 635)	4440±60			3360–2900	*3340–3205* (*32%*) or *3195–2920* (*63%*)
UCD-C24	G-118-323	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Annagh Beg, 1.80 m above mineral soil	4440±60			3360–2900	*3335–3205* (*31%*) or *3195–2920* (*64%*)
UCD-C38	G-119-323	Sub-fossil *Pinus sylvestris* stump	Growing on bog which had grown over field system at Annagh Beg, 1.40 m above mineral soil	3820±60			2470–2040	*2470–2130* (*93%*) or *2085–2055* (*2%*)
Erris region, Co. Mayo								
UCD-C01	F-784-338	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Inver, 0.75 m above mineral soil	4240±60			2930–2630	
UCD-C02	F-857-351	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Aghoos, 0.65 m above mineral soil	4340±60			3270–2870	
UCD-C12	F-854-356	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Aghoos, 0.75 m above mineral soil	3950±60			2620–2280	
UCD-C05	F-824-356	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Carnhill, 1.35 m above mineral soil	4250±60			3010–2670	
UCD-C13	F-781-309	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Muings 2.00 m above mineral soil	3990±60			2840–2300	
UCD-C16	F-927-339	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Bunalty, 0.65 m above mineral soil	4490±60			3370–2970	
UCD-C19	F-803-338	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Gortmelia, 0.10 m above mineral soil	4530±60			3500–3020	
UCD-C20	F-817-314	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Carrowmore, 0.65 m above mineral soil	4230±60			2930–2630	
UCD-C25	F-875-272	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Glencullin, 0.15 m above mineral soil	4460±60			3370–2910	
UCD-C35	F-791-376	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Graghil, 0.40 m above mineral soil	4440±50			3350–2910	
UCD-C36	F-815-356	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Gortbrack North, 1.25 m above mineral soil	3090±50			1460–1210	
UCD-C43	F-848-318	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Muingerron South, 0.30 m above mineral soil	4080±60			2880–2470	
UCD-C41	F-848-318	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Muingerron South, on mineral soil	6720±90			5760–5480	
UCD-C52	F-753-149	Sub-fossil *Pinus sylvestris* stump	Growing on bog at Tullaghanbaun at unknown distance above mineral soil	4070±60			2880–2460	
UCD-C48	F-753-149	Sub-fossil *Pinus sylvestris* stump	On 0.80 m of peat in intertidal zone at Blacksod Bay, above sample for UCD-C54	7530±100			6600–6210	

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
UCD-C54	F-753-149	Peat	Intertidal peat at Blacksod Bay, Tullaghanbaun, below sample for UCD-C48	8660±130			8210–7490	
Valencia Island, Co. Kerry								
I-14206		Waterlogged *Salix* twigs at base of wall	Sheet of willow twigs at base of wall provides *terminus post quem* for construction (F. Mitchell 1990)	4760±100			3710–3350	*3775–3340*

only after it began to develop. Thus, although in most cases it is not known which part of the tree was sampled for radiocarbon dating, all these dates should provide *termini ante quos* for the disuse of the field system that was covered by the peat in which the trees were rooted. The same applies to two trees (*UCD-C26, -C49*) which were actually rooted in field walls, where they could not have grown unless the walls were already peat-covered. Two further trees (*UCD-C18, -C50*) were rooted in the soil at the base of the peat, and may have started to grow before peat began to form. They must have died after or only shortly before this occurred locally, however, otherwise they would not have been preserved. As the parts of the trees that were dated are unknown, it is possible that the dated rings may have grown before peat initiation. These two measurements, therefore, provide only *termini post quos* for the end of the bog pine phase in this area and do not contribute to the estimate for the start of peat growth.

Four dates are excluded from the model because they seem to relate to early, localised pockets of peat growth (Table 12.6). UCD-C42 and -C44 date pine stumps from near the edge of the deep basin at Glenulra where one would expect peat to have spread early. UCD-C46 and -C47 from Geevraun in Belderrig also seem to be exceptionally early. SI-1469 and -1470, measured on pine stumps from Belderg (Table 12.6), are excluded from the model because dates measured at the same time on samples from the nearby Bronze Age settlement (Table 12.6: SI-1471–5) include two that appear to be anomalously recent (SI-1474–5; Caulfield 1978, 42). Given this and the anomalously recent dates for Ballyglass from the same laboratory (discussed above), caution seems appropriate.

Where it is possible to compare dates for stumps growing on or just above the mineral soil and dates for the base of the peat in a single area, that of the Behy court tomb, the stumps (Fig. 12.39: *UCD-C45, -C51, -C57*) are earlier than the base of the peat (Fig. 12.38: *UB-158F*, *0.00–0.01 m above base*, *GrN-20029*, *Gd-6694*, *GrN-20027*), the two sets of dates being statistically inconsistent ($T'=259.1$; $T'(5\%)=14.1$; $\nu=7$). Pine thus started to grow before peat extended beyond the basin.

One of several other areas where pre-bog field walls occur is Valencia Island, Co. Kerry (Mitchell 1989, 75). *I-14206*, measured on a sample from a sheet of willow twigs at the base of one wall, provides a *terminus post quem* for its construction (Fig. 12.40).

An overall model for the chronology of the field systems of the Céide Fields and Valencia Island is provided in Fig. 12.40. The establishment of the Céide Fields is best dated by the start of the major clearance episode visible in the Glenulra pollen record, which suggests that they were laid out in *3960–3540 cal BC* (*95% probability*; Fig. 12.37: *start clearance*), probably in *3845–3635 cal BC* (*68% probability*). The fields seem to have gone out of use in the second half of the fourth millennium cal BC (Fig. 12.40), since pine woodland appears to have become established over the fields. We have two independent estimates for the date when this woodland became established. These

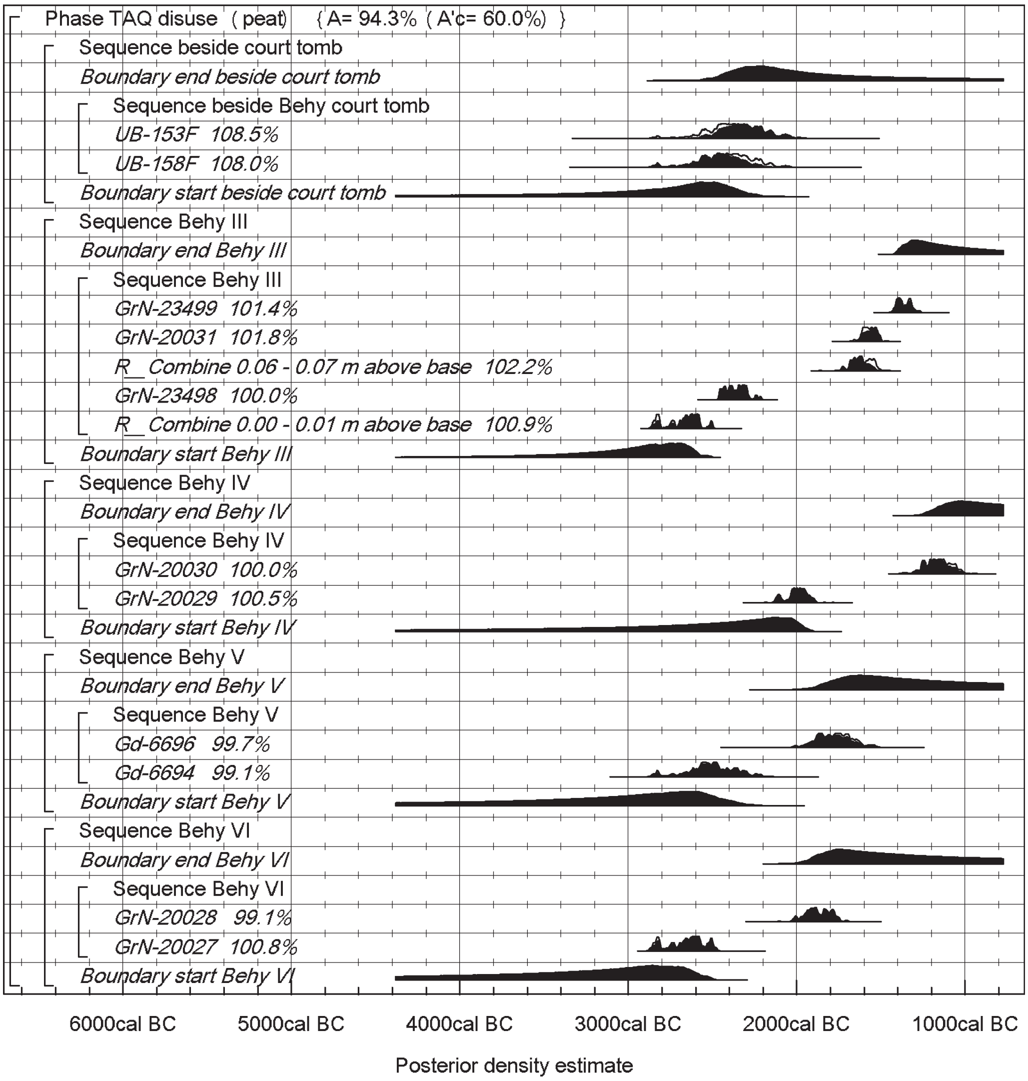

Fig. 12.38. Céide Fields. Probability distributions of dates from sequences through overlying peat. The format is identical to that of Fig. 12.6. The large square brackets down the left-hand side, along with the OxCal keywords, define the overall model exactly.

are divergent. On the basis of the waterlogged bog pines, pine became established from *3630–3245 cal BC* (*95% probability*; Fig. 12.39: *start stumps*), probably from *3465–3305 cal BC* (*68% probability*). The evidence for woodland regeneration, including a marked increase in pine pollen, in the Glenulra pollen record occurs slightly later, in *3300–2960 cal BC* (*95% probability*; Fig. 12.37: *start regeneration*), probably in *3210–3040 cal BC* (*68% probability*). A model which constrains the start of regeneration to be earlier than the first bog pine has poor overall agreement ($A_{overall}$=50.1%, and for *start regeneration*, A=20.2%). The difference between these two estimates for the initiation of the pine forest amounts to *40–515 years* (*95% probability*; distribution not shown), probably to *145–380 years* (*68% probability*). It may be that the two kinds of evidence do not relate to the same event; perhaps the local establishment of pine within the catchment of the pollen record at Glenulra was later than the very first growth of pine within the larger area of the field system. The estimate for this earliest establishment of pine forest provided by the bog pines is more spatially representative than that of the single pollen record from Glenulra. It seems plausible to suggest that the spread of pine across the field system was a process rather than a single event. The start of this process may therefore be most accurately dated by *start stumps*, with *start regeneration* reflecting its continuation in a particular locality. Similarly, it is conceivable that the abandonment of the Céide Fields was also a process rather than an event. Current evidence, however, indicates the establishment of the system in the first half, perhaps the second quarter, of the fourth millennium cal BC, and its disuse in the second half, probably from the third quarter of that millennium. Blanket bog encroached from the middle of the third millennium cal BC (Fig. 12.40). The single date for Valencia Island could be compatible with the use of that system in the mid-fourth millenium cal BC.

These models reinforce the original arguments of the excavator for a relatively early date for the Céide Fields (Caulfield 1978; 1983; Caulfield *et al.*1998). Further

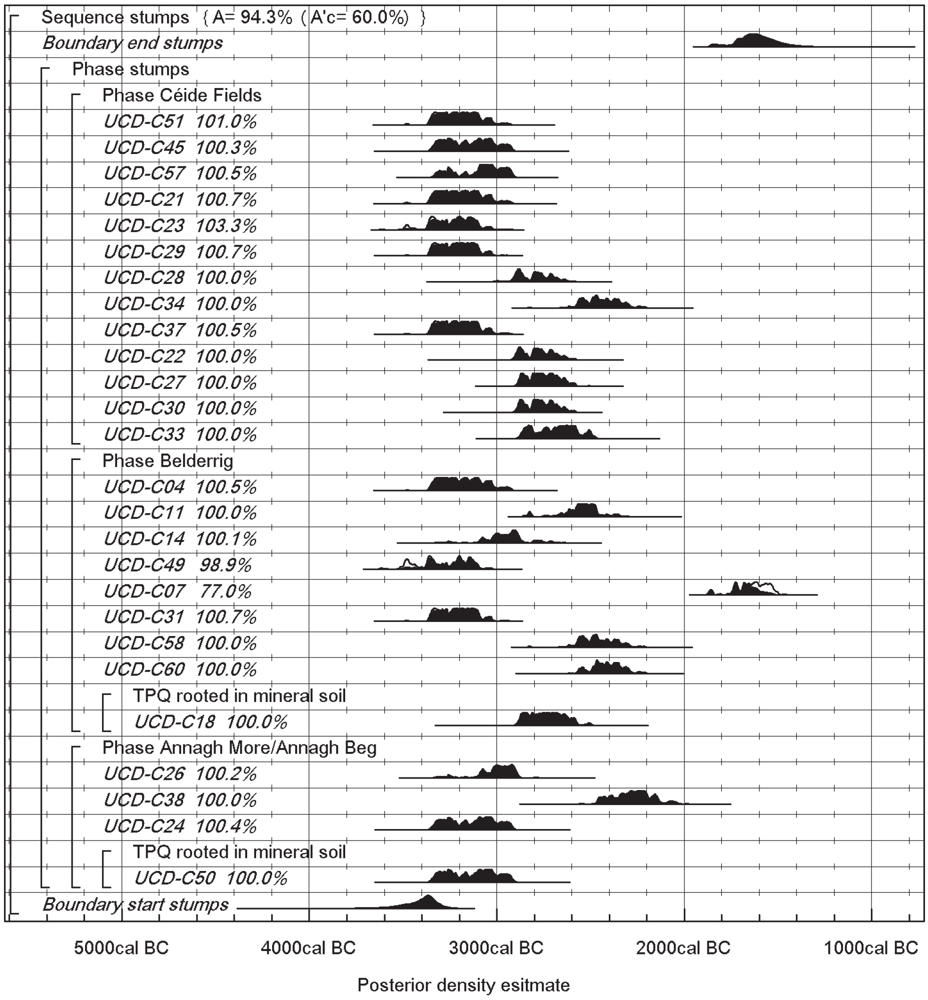

Fig. 12.39. Céide Fields. Probability distributions of dates from tree stumps preserved in the peat growing over the area. The format is identical to that of Fig. 12.6. The large square brackets down the left-hand side, along with the OxCal keywords, define the overall model exactly.

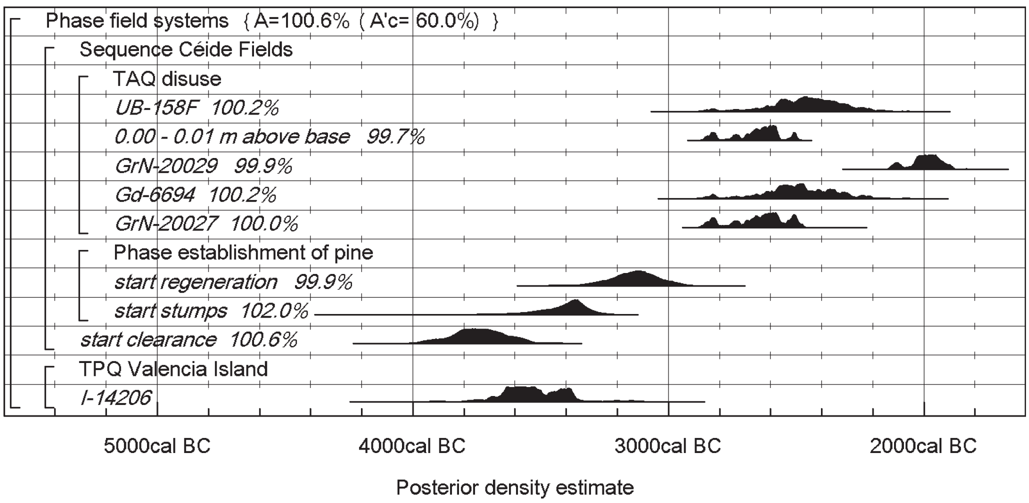

Fig. 12.40. Céide Fields and Valencia Island. Key parameters relating to the chronology of early fields, derived from the models defined in Figs 12.37–9.

dating evidence, not available when the models were built, is available from renewed work at Belderg More by Graeme Warren. Apart from documenting Mesolithic activity through the mid- to late fifth millennium cal BC, this project has demonstrated progressive local changes in the layout of the walls and obtained mid-fourth millennium cal BC dates on short-life samples from a hearth sealed by tumble from a nearby field wall which had accumulated

before peat started to grow. While the relation of the hearth to the wall is unknown, the measurements provide *termini post quos* for the start of peat growth at this location (Table 12.6: UB-7590–1, UBA-7591; Warren 2009a; 2009b; Warren *et al.* 2009). Given other, comparable evidence from northern Co. Mayo (Cooney 2000a, 46), we can assert that this was at the very least a regional rather than a purely localised phenomenon (see also O'Connell and Molloy 2001). Summarising evidence from other parts of Ireland, it has been suggested (Cooney 2000a, 46–7) that the organisation of landscapes into fields was recurrent rather than exceptional. Other pre-bog examples include Valencia Island (G. Mitchell 1989, 75) and the walls on the Burren, for example at Roughan Hill, which appear on the surface as low grass-covered mounds. On the basis of the height of the limestone bedrock pedestals protected from erosion by the walls, C. Jones (2004, 63) argues that at Roughan Hill the majority are dated to the Final Neolithic/Early Bronze Age but points out that some mound walls have higher pedestals and are probably older.

The role of the fields within systems of production and tenure, in the context of an Atlantic setting seemingly ideally suited to grass growth, has already been explored by Seamas Caulfield (1978; 1983). The investment in stone wall construction is striking, on a cumulative scale probably exceeding the building of the later, major passage tombs. There is no inherent reason why even close management of herds should require stone walls. Perhaps, therefore, we can think in wider ways about their significance. Was this a distinctive way of signing the land, an expression of regional identity or identities, a means of aligning people with the substance of the earth and its mythic properties, and a medium through which community could be assembled and tied to place? This line of argument is supported by the location of the walls at Caltragh, south of the Magheraboy causewayed enclosure, separating areas of wet and dry ground (Danaher 2007, 65).

Following the conclusion of the pollen analysts that the abandonment of the field system at Céide had nothing directly to do with blanket bog encroachment (Molloy and O'Connell 1995), Caseldine *et al*. (2005) and Verrill (2006) have suggested that abandonment may have coincided with a period of unstable climate and increased storminess (see discussion above).

Trackways

The construction of wooden trackways could easily have been within the technological capabilities of foragers in Ireland, who after all possessed flint and stone axeheads, and Mesolithic wooden platforms have been found, as at Mitchelstowndown East, Co. Limerick (Brindley and Lanting 1998, 57), and Derragh on Lough Kinale in Co. Longford (Fredengren 2007). The possibility of a Mesolithic trackway in Lullymore Bog, Co. Kildare, is a real one, although doubt is raised by the disparity between late sixth/early fifth millennium cal BC dates for both bog pine below the track and peat above it and late seventh/early sixth millennium dates for the track itself (Brindley and Lanting 1998, 47, 57–8). This may mean that the track was built of bog pine older than that on which it lay. Brindley and Lanting see the Lullymore track as built to meet very specific local needs and can point to very few Mesolithic examples in north-west Europe, track building becoming more frequent from the start of the Neolithic. For this reason, we suggest that the construction and use of trackways are a kind of modification of the landscape which proliferated with the Neolithic. The earliest known dated example from Britain, the Sweet Track in the Somerset Levels, was already a substantial undertaking (see Chapter 4).

Trackways from five locations (four in the Irish midlands) have been dated to the fourth millennium cal BC (Fig. 12.41). At Corlea, Co. Longford (Raftery 1996), four brushwood trackways, numbers 8–11, have been dated, each by a sample of waterlogged hazel roundwood (Table 12.7: GrN-16830–1, -18375–6). At Derrygreenagh, Co. Westmeath, a timber from a trackway yielded a dendrochronological *terminus post quem* for felling of 3643±9 BC (Conor McDermott, pers. comm.). Brushwood trackways at Cloncreen Bog and at Ballykilleen, Co. Offaly, have been dated by Wk-11733 and Wk-11729 respectively, and at Killeens Bog, Co. Cork, trackway 2a is dated by UCD-0216 (Conor McDermott, pers. comm.).

'Undiagnostic' pottery

There are two further sites where pottery has been dated to the fourth millennium cal BC. At the time when the models in this chapter were constructed, we were uncertain about the character of this material. The pottery from these two sites was therefore modelled as 'undiagnostic' within the list of definitely Neolithic activity, though one find has since been attributed to a specific style, and it is referred to subsequently in this chapter in inverted commas.

At Lough Gur, the burial of a crouched juvenile in a pit (F101) was dated to 3640–3360 cal BC (95% confidence; Table 12.8: GrN-16825; Brindley and Lanting 1990; Cleary 1995). This forms part of a tradition of individual burial during the Neolithic at Lough Gur which seemed to be focused on children (Grogan and Eogan 1987), and included a burial of an adolescent with a decorated, bipartite bowl at Site C (Ó Ríordáin 1954; Herity 1982). The child in F101 overlay some patinated flint flakes and was accompanied by a chip of a stone axehead; there were also six sherds of corky-textured pottery in the fill of the grave (Cleary 1995). It is possible that this material was associated with the burial, although it is also possible that it is redeposited, and that the burial formed part of the same phase of activity as the decorated, bipartite Bowl (Herity 1982, 299, fig. 26:25). The radiocarbon date accords with either interpretation (Fig. 12.41).

Human bone from a skeleton in a pit at Clane, Co. Kildare, which it is now clear was associated with a simple decorated bowl of middle Neolithic style (Ryan 1980), has been dated by *GrN-12276* (Fig. 12.41).

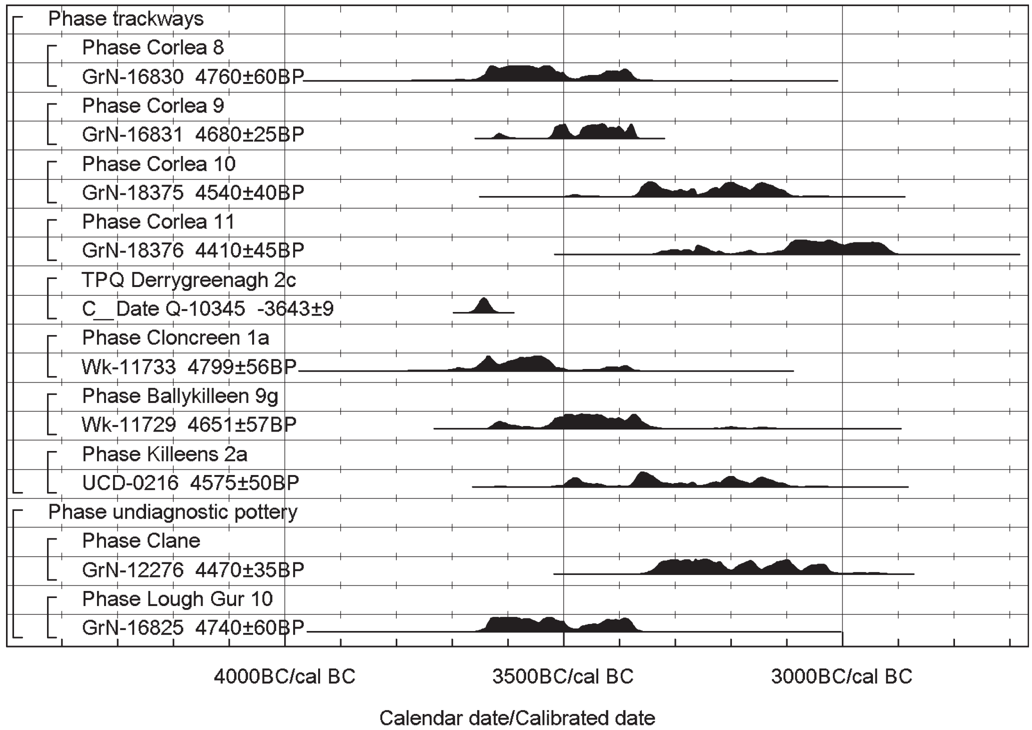

Fig. 12.41. Fourth millennium cal BC trackways and burials with 'undiagnostic' pottery. Calibrated dates (Stuiver and Reimer 1993).

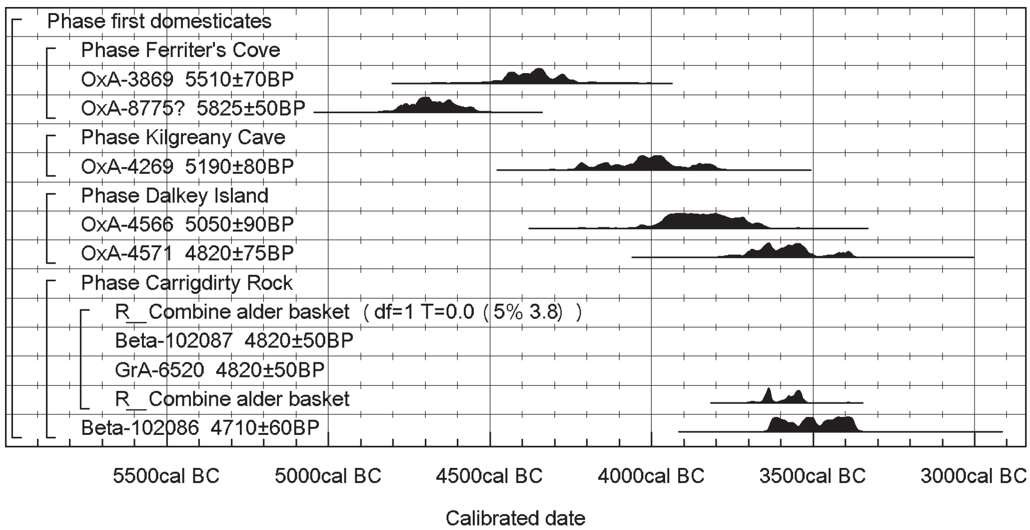

Fig. 12.42. Early domestic fauna in Ireland. Calibrated radiocarbon dates (Stuiver and Reimer 1993).

Domesticates

Seven cattle bones and a single sheep tooth (both species absent from Ireland in the early Holocene) came from a late Mesolithic milieu at Ferriter's Cove, Co. Kerry; two of the cattle bones have been dated to the fifth millennium cal BC (Fig. 12.42: OxA-3869, -8775; Woodman *et al.* 1999, 89–92, 144–51). These have been seen as the earliest evidence for the introduction of at least one element of Neolithic practice into the island and have been the subject of considerable discussion (e.g. Woodman and McCarthy 2003; Sheridan 2003a; Tresset 2003). In contrast to the variety and quantity of fish (and shellfish) resources, the remains of mammals and birds at Ferriter's Cove were scarce (Woodman *et al.* 1999, 92), and the stable isotope signatures of the human remains from the site, the two dated examples of whom died in the late fifth millennium cal BC (Table 12.9: OxA-4918, -5770; Woodman *et al.* 1999, 85–103), indicate a diet which included a large component of marine resources.

Woodman and McCarthy (2003, 33) suggest that the cattle and sheep represent little more than a dietary supplement to people who relied on marine sources,

Table 12.7. Radiocarbon dates relating to fourth millennium cal BC trackways in Ireland.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)
Corlea Bog, Co. Longford						
GrN-16830		Waterlogged *Corylus* roundwood, 22 mm diameter, 6 rings	Corlea 8.Trackway (B. Raftery 1996, 79–81; Brindley and Lanting 1998, 50)	4760±60	−28.5	3660–3370
GrN-16831		Waterlogged *Corylus* roundwood, 90 mm diameter, *c.* 20 rings	Corlea 9. Trackway (B. Raftery 1996, 81–91; Brindley and Lanting 1998, 50)	4680±125	−28.1	3630–3360
GrN-18375		Waterlogged *Corylus* roundwood, 65 mm diameter, 20–30 rings	Corlea 10. Trackway (B. Raftery 1996, 91; Brindley and Lanting 1998)	4540±40	−28.0	3370–3090
GrN-18376		Waterlogged *Corylus* roundwood, 40 mm diameter, 21 rings	Corlea 11. Trackway (B. Raftery 1996, 91–2; Brindley and Lanting 1998, 50)	4410±45	−29.3	3330–2900
Derrygreenagh Bog, Co. Westmeath						
Q10345	OF-DGH 0002c	Dendro date start 3988 BC, end 3675 BC, felling 3643±9 BC or later	Derrygreenagh 2c. Trackway			
Cloncreen Bog, Co. Offaly						
Wk-11733 (standard radiometric)	OF-CCR 001A	Waterlogged brushwood. 'I filtered the list to include only primary context dates where possible. For the most part there should be no issue regarding the 'old wood effect' or other anomalies as it is the general practice on such sites to choose a small piece of wood with a low ring count as there is usually an abundance of wood available to choose from. Where there was evidence of phasing identified by the excavator…I clearly indicate this in the label for the dates.' (Conor McDermott, pers. comm., Sept. 2006)	Cloncreen 1a .Trackway	4799±56	−28.9±0.2	3700–3370
Ballykilleen Bog, Co. Offaly						
Wk-11729 (standard radiometric)	OF-BKL 0009g	Waterlogged brushwood. Same comment from Conor McDermott above applies	Ballykilleen 9g. Trackway	4651±57	−27.1±0.2	3630–3340
Killeens Bog, Co. Cork						
UCD-0216	OF-KEN 0003a	Waterlogged wood. Same comment from Conor McDermott above applies	Killeens 2a. Trackway	4575±50		3500–3090

Table 12.8. Radiocarbon dates relating to burials with 'undiagnostic' pottery in Ireland.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)
Lough Gur, Co. Limerick						
GrN-16825	Lough Gur 10	Human. Bone	F101. From grave of 6–8 year-old child overlying patinated flint flakes and accompanied by a greenstone chip. 6 sherds of corky-textured ware in backfill, 1 of them shouldered (Cleary 1995; Brindley and Lanting 1990)	4740±60	−20.6	3640–3360
Clane, Co. Kildare						
GrN-12276		Human. Bone	Skeletons of 2 juveniles in small pit, accompanied by simple bowl with vertical and horizontal scores. One of a cemetery of 2 probably flat graves (Brindley and Lanting 1990; Herity 1982, 298, fig. 23:3; M. Ryan 1980)	4470±35	−20.9	3350–3010

Table 12.9. Radiocarbon dates for early occurrences of cattle and caprines in Ireland.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)
Dalkey Island, Co. Dublin							
OxA-4566	Humerus E 46	Sheep. Humerus	Southern basal midden Site II. Shell midden overlying cache of later Mesolithic artefacts but containing Neolithic artefacts and a Neolithic burial. Two other animal bone dates from this context fall in the sixth and second millennia cal BC (OxA-4567–8; D. Liversage 1968; Woodman *et al.* 1997, 137–8)	5050±90	−19.6		4040–3640
OxA-4571	Vertebra E-46	Cattle. Vertebra	Northern basal midden Site V. Shell midden containing later Mesolithic artefacts. Three other animal bone dates from this context fall in the seventh, sixth and fifth millennia cal BC; charcoal from inside limpet shells is dated to the late fifth/early fourth millennium (OxA-4569–70, -4572, D-38; D. Liversage 1968; Woodman *et al.* 1997, 137–8)	4820±75	−21.4		3760–3370
Kilgreany Cave, Co. Waterford							
OxA-4269	Tibia F20297	Cattle. Tibia	Context 8/lower stratum level KE1. Tufaceous stalagmite between C9, which contained a burial dated by Pta-2644 and C7, which contained a burial dated by BM-135 (Molleson 1986; Dowd 2002; 83; Woodman *et al.* 1997; R. Hedges *et al.* 1997)	5190±80	−22.5		4240–3790
Ferriter's Cove, Co. Kerry							
OxA-3869	Ulna E263	Cattle. Tibia	Context 302 (1992). One of six cattle bones found near each other in the southern area of the site (Woodman *et al.* 1997; Woodman *et al.* 1999, 21, 90)	5510±70	−20.5*		4490–4230
OxA-8775		Cattle. Lateral portion of charred metatarsus. Entire specimen used for dating	Recovered from bulk sample from silt near a hearth in the central area of the site (Woodman *et al.* 1999, 14, 90)	5825±50	−23.0		4800–4540
Carrigdirty Rock, Co. Limerick							
Beta-102087		Waterlogged basket woven from thin alder shoots	Carrigdirty Rock 5. Found in 3 fragments in scatter of worked and charred wood, a small slate axe, 2 chert flakes, possible pebble hammerstones, human, cattle and swan bone and hazelnut fragments (some charred) on foreshore of Shannon estuary, seen as a brief, small-scale episode (A. O'Sullivan 2001, 73–86)	4820±50		4820±35 T'=0.0; T'(5%)=3.8; ν=1	3660–3520
GrA-6520		Replicate of Beta-102087	From the same context as Beta-102087	4820±50	−24.9		
Beta-102086		Human. Skull fragment	From the same context as Beta-102087	4710±60			3640–3360

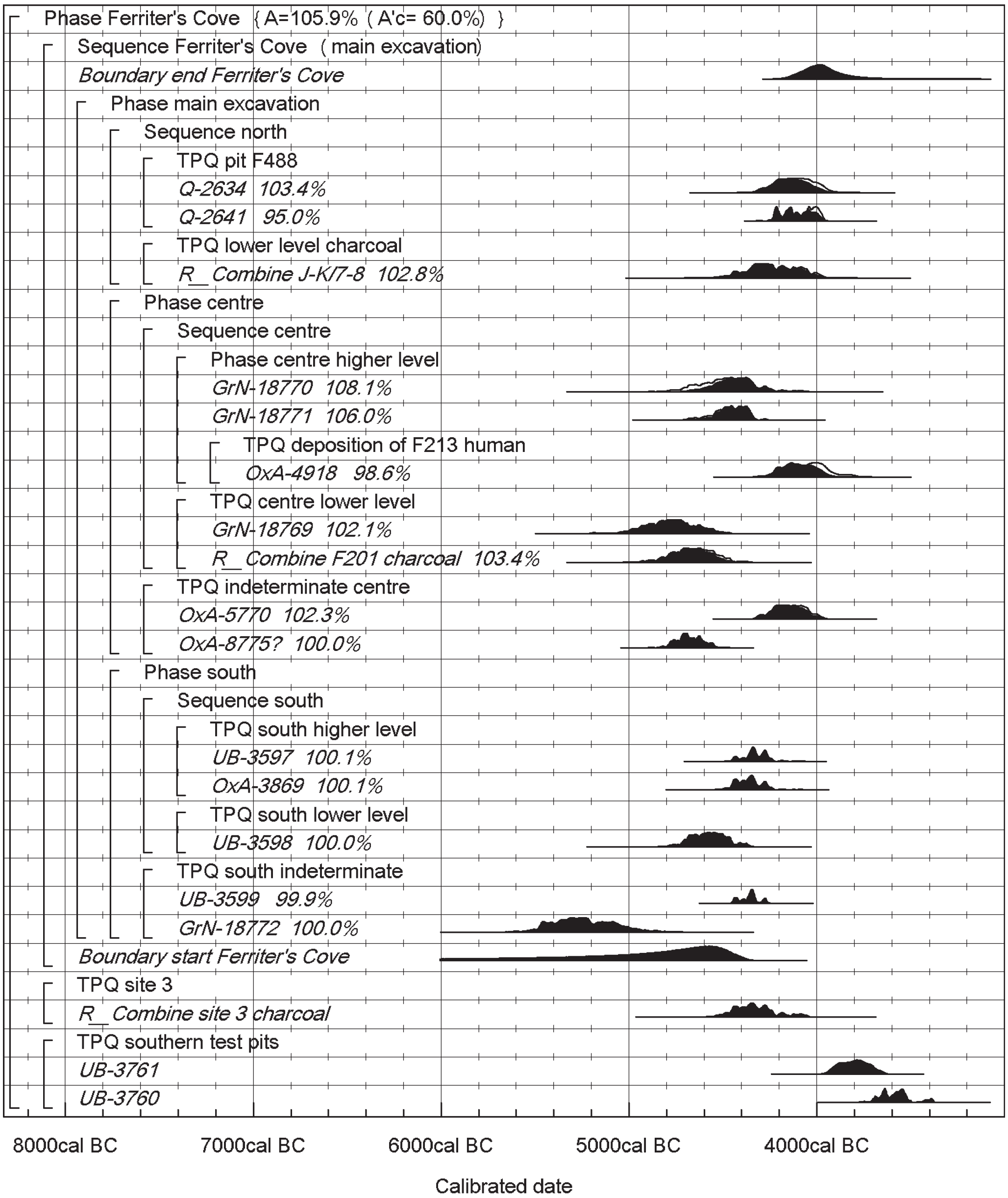

Fig. 12.43. Ferriter's Cove. Probability distributions of dates. The format is identical to that of Fig. 12.6. The large square brackets down the left-hand side, along with the OxCal keywords, define the overall model exactly.

but that the presence of domesticates may have had social consequences. The older of the two cattle bone measurements, OxA-8775, is excluded from the model because it was made on a bone which was charred and may thus have incorporated exogenous carbons of different age to itself (Gillespie 1989; Ambers *et al.* 1999, 331). This may be confirmed by the slightly enriched $\delta^{13}C$ value for this sample. The more recent date, OxA-3869, is earlier than any other for domestic fauna from Ireland, although its calibrated distribution overlaps with that for a cattle tibia from Kilgreany Cave, Co. Waterford (Table 12.9; Fig. 12.42: OxA-4269; Woodman *et al.* 1997; Dowd 2002). At Ferriter's Cove, the bone dated by OxA-3869 and the others near it were not closely associated with any specific focus of activity (Woodman and McCarthy 2003, 33) and the Kilgreany Cave tibia was clearly redeposited, since it pre-dates an articulated burial stratified below it (Table 12.13: Pta-2644); Neolithic artefacts were present in the cave, although their relation to the tibia or to the several burials there is uncertain (Dowd 2002, 82–4). At both Ferriter's Cove and Kilgreany it is the species that is significant, regardless of the context. These two specimens may be evidence for an initial introduction of cattle into Ireland in the later fifth millennium cal BC. This will be clarified only by further work.

The credibility of OxA-3869 from Ferriter's Cove is enhanced by the good agreement achieved when it is modelled with the other results from the site ($A_{overall}$=105.9%; Fig. 12.43; Table 12.10). Activity was clearly intermittent, since features occurred at varying levels in the silt which overlay the wave-cut platform occupied by the site; the density and composition of the lithics varied vertically and

Table 12.10. Radiocarbon dates from Ferriter's Cove, Co. Kerry. Posterior density estimates derive from the model defined in Fig. 12.43.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
North								
BM-2227R		'A general charcoal sample' (unidentified). NB most of the identified charcoal from adjacent 1 m squares was *Quercus* (McKeown 1999, 214–5)	1983 J–K/7–8. Patch of shells, charcoal and charcoal-rich soil, at edge of cliff, in lower level of silt (Woodman *et al.* 1999, 11–12, 108–110, figs 2.1–2, 7.1)	5400±220	−29.4	5414±124 T'=0.0; T'=(5%)=3.8; ν=1	4500–3960	*4465–3990*
BM-2227AR		Replicate of BM-2227R	From the same context as the sample for BM-2227R	5420±150	−29.1			
Q-2641		Charcoal (unidentified)	Pit F488. Large pit with burnt basal layer and lens of unburnt shell, charcoal and burnt soil. In upper level of silt (Woodman *et al.* 1999, 12, 108–110, figs 2.1–2, 7.1)	5245±55			4240–3950	*4235–3975*
Q-2634		Marine shells	From the same context as sample for Q-2641. Both submitted as part of a project to compare dates on charcoal and marine shells from the same contexts	5680±70			4320–3925[1]	*4310–3970*
Centre								
GrN-18770		Charred hazelnut shells	F43. Small area of burnt hazelnut shells at N edge of F3 and at same level (Woodman *et al.* 1999, 20)	5620±130	−25.7		4770–4230	*4685–4225* (*94%*) or *4200–4170* (*1%*)
GrN-18771		Charred hazelnut shells	C132. Concentration of charred hazelnut shells near top of hearth overlying naturally silted hollow F133 (Woodman *et al.* 1999, 16–17, fig 2.4)	5620±80	−25.7		4690–4330	*4610–4325*
OxA-4918		Human. Probable femur fragment	C213. Lying W of and close to F5 but at a higher level (Woodman *et al.* 1999, 14–15, 110–1, figs 2.5, 7.2; Power 1999, 103)	5545±65	−13.9		4245–3805[2]	*4265–3930*
OxA-5770		Human. Tooth	K–L/3–4. From bulk sample taken from north of F5 (Woodman *et al.* 1999, 15, fig. 2.4; Power 1999, 103)	5590±60	−14.1		4330–3970[3]	*4315–4010*
OxA-8775		Cattle. Lateral portion of charred metatarsus. Entire specimen used for dating	Recovered in fragments from bulk sample from silt south of F5 (Woodman *et al.* 1999, 14, 90, fig. 2.5)	5825±50	−23.0		4800–4540	
BM-2228R		Charcoal (unidentified)	F201. Concentration of bone, artefacts and burnt rock, close to F5, on incipient soil, at base of silt (Woodman *et al.* 1999, 13–16, 110–1, figs 2.4, 7.2)	5750±140		5804±95 T'=0.3; T'=(5%)=3.8; ν=1	4900–4450	*4900–4860* (*2%*) or *4855–4480* (*93%*)
BM-2228AR		Replicate of BM-2228R	From the same context as sample for BM-2228R	5850±140	−29.1			
GrN-18769		Charcoal (unidentified)	F5. Hearth, just NW of F201, on incipient soil, at base of silt (Woodman *et al.* 1999, 13–14, 110–11, figs 2.5, 7.2)	5900±110	−25.6		5050–4490	*5050–4525*
South								
OxA-3869	Ulna E263	Cattle. Tibia	C302. One of six cattle bones found near each other at relatively high level in silts (Woodman *et al.* 1997; Woodman *et al.* 1999, 21, 90, 111)	5510±70	−20.5[4]		4490–4230	*4500–4230*

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
UB-3598		Charcoal (unidentified) and 'significant quantities of burnt hazelnut shells' (Woodman *et al.* 1999, 114)	C309. Layer underlying burnt surface F308, at a lower level than F303 (Woodman *et al.* 1999, 24, 113–14, fig. 2.15)	5727±81	−25.3		4780–4360	*4730–4435* (*90%*) or *4430–4365* (*5%*)
UB-3597		Charcoal (unidentified)	F303. Spread of burnt stone and shell close to F309 and at a higher level (Woodman *et al.* 1999, 24, 113–14, fig. 2.15)	5479±56			4450–4230	*4455–4230*
UB-3599		'Large lumps' of charcoal (unidentified; Woodman *et al.* 1999, 114)	C341. Charcoal-rich lens within pit F355 (Woodman *et al*. 1999, 21–2, fig. 2.11)	5503±45	−26.1		4450–4260	*4455–4315* (*83%*) or *4300–4260* (*12%*)
GrN-18772		Charcoal (unidentified)	Scatter of charcoal in area of shell midden F183, in extreme SW of main excavated area (Woodman *et al*. 1999, 26, figs 2.11, 2.27)	6300±140	−25.2		5530–4910	*5530–4930*
Site 3								
BM-2229R		Charcoal (unidentified)	Area of burnt soil surrounded by dark, char-coal-rich deposit, *c.* 20 m S of main excavation (Woodman *et al*. 1999, 173–4, figs 1.1, A.4)	5490±160	−28.3	5496±101 T'=0.0; T'(5%)=3.8; ν=2	4540–4050	*4540–4145* (*88%*) or *4135–4050* (*7%*)
BM-2229AR		Replicate of BM-2229R	From the same context as sample for BM-2229R	5500±130	−29.1			
Southern test pits								
UB-3760		Charcoal (unidentified)	Shell midden exposed in cliff *c.* 60 m S of main excavation (Woodman *et al.* 1999, 170–2, fig. 1.1)	4820±67	−26.3		3710–3370	*3715–3495* (*87%*) or *3440–3375* (*8%*)
UB-3761		Marine shells	From the same context as sample for UB-3760	5402±24	+1.6		3950–3640[1]	*3935–3660*

1. Calibrated using marine data from Hughen *et al.* 2004 with a local reservoir correction of 22±54 BP (Harkness 1983)

2. Calibrated using a mixture of 84±8% marine data from Hughen *et al.* 2004 with a local reservoir correction of 22±54 BP (Harkness 1983) and 16±8% terrestrial data (Reimer *et al*. 2004)

3. Calibrated using a mixture of 74±8% marine data from Hughen *et al.* 2004 with a local reservoir correction of 22±54 BP (Harkness 1983) and 26±8% terrestrial data (Reimer *et al*. 2004)

4. −20.5 in monograph, −18.1 on Oxford Lab's website. Footnote on p 144 of monograph reads 'When first published . . . a $\delta^{13}C$ estimation of −18.1 ‰ was noted. The Oxford Accelerator Laboratory has since noted that $\delta^{13}C$ reading made at the time of the dating of this cattle bone lacked precision, and a recent estimate of −20.5‰ is more accurate'

horizontally; and there were discrete clusters of refitting artefacts (Woodman *et al.* 1999, 108–24). All the radiocarbon dates were measured either on bulk samples of unidentified charcoal, charred hazelnuts or marine shells, or on single fragments of disarticulated bone. The marine shell dates have been calibrated using the curve of Hughen *et al*. (2004), with a local ΔR correction of 22±54 BP (Stuiver and Braziunas 1993; Harkness 1983). The two human bone samples have $\delta^{13}C$ values of −13.9 and −14.1 and have therefore been calibrated using a mixture of the terrestrial calibration curve (Reimer *et al*. 2004) and the marine dataset with the same ΔR correction. The proportion of marine protein in each individual's diet has been estimated by linear interpolation based on the ranges of $\delta^{13}C$ values for terrestrial and marine food sources published by Mays (1998). OxA-5770 has therefore been calibrated using a figure for marine input of 74±8%; OxA-4198 has been calibrated using a figure for marine input of 84±8%.[12] All other determinations have been calibrated using the terrestrial dataset.

Two measurements are available on bulk samples of charred hazelnuts (Fig. 12.43: *GrN-18770–1*). Because the samples came from discrete concentrations, these are likely to have resulted from single events (Woodman *et al.* 1999, 16–17, 20). These are the only two short-life samples from Ferriter's Cove which are plausibly not residual. The charcoal dates are treated as *termini post quos*, since their samples could have comprised fragments of various ages, including some of mature wood, especially as most of the identified charcoal from the site was oak (McKeown 1999). Some such samples, such as *Q-2641* (Table 12.10), derived from discrete concentrations of charcoal which may represent single episodes, but they may still contain significant age offsets. Others, such as *GrN-18772*, come from general scatters of charcoal, which may include material of diverse ages. The two marine shell dates (Fig. 12.43: *Q-2634, UB-3761*) are treated as *termini post quos* because their samples too could have been heterogeneous. It should be noted, however, that in both cases where a pair of dates are available on marine shell and unidentified bulk charcoal from the same context, the calibrated dates are similar. This may suggest that in fact this material has not been significantly reworked. Dates on disarticulated bone (Fig. 12.43: *OxA-4918, -5770, -3869,* -8775) are treated as *termini post quos* because the creatures from which they came could have been long dead when the bones were finally buried. OxA-8775 is excluded from the model for the reason explained above.

On this basis, the use-life of the contiguous central, north and south parts of the main excavated area at Ferriter's Cove can be estimated as starting in *5780–4380 cal BC* (*95% probability*; Fig. 12.43: *start Ferriter's Cove*), probably in *5060–4420 cal BC* (*68% probability*). This distribution is imprecise because it depends on only the two samples of hazelnuts which are interpreted as deriving from discrete archaeological episodes. It is skewed towards the middle of the fifth millennium cal BC (Fig. 12.43). The occupation can be estimated as ending in *4175–3710 cal BC* (*95% probability*; Fig. 12.43: *end Ferriter's Cove*), probably in *4090–3895 cal BC* (*68% probability*). Although the dated activity probably occurred in the second half of the fifth millennium cal BC (Fig. 12.43), the imprecision of the dating estimates should be not be confused with persistence of archaeological activity. The radiocarbon dating would accord equally with an interpretation that this activity derived from a number of short-term occupation episodes at intervals during this period. On the evidence of two radiocarbon dates from testpits to the south of the main excavations, activity of similar character appears to continue into the first half of the fourth millennium cal BC (Fig. 12.43: *UB-3760–1*), the scant associated lithics being undiagnostic (Woodman *et al.* 1999, 170–2).

Ferriter's Cove highlights several important points. Activity at the site was probably episodic, as the character of the deposits strongly suggests. One date from the main excavated area indicates contact with elsewhere, in the form of cattle bone, in the later fifth millennium cal BC. This and a single sheep tooth, which failed to date (Woodman *et al.* 1999, 90), may genuinely represent a single event. The cattle bones in question are not sufficiently numerous or substantial to establish whether the animal or animals in question were alive or dead; even the transport of clean bones is not inconceivable, though the idea of a live animal or animals may be more appealing to the imagination. Whether the bones are sufficiently diagnostic to make it certain that they were from domesticated animal(s) is a question that should be raised for re-examination and re-confirmation. The movement of aurochs (as live animals, meat or bone) would still be of great interest, but it could entail only contact with western Britain rather than with continental areas where domesticated cattle were already present in the late fifth millennium (and see Chapter 15). The remaining cattle bones from Ferriter's Cove must be a high priority for further dating.

Dalkey Island, Co. Dublin, a small island 400 m off the east coast of Ireland, has also long been considered an important site in the discussion of the Mesolithic-Neolithic transition (e.g. Woodman 1976; 1978a; 1981). Excavations revealing multi-period activity on the island were carried out in the 1950s (Liversage 1968), Mesolithic and Neolithic activity being focused on a shell midden which extended for at least 10 m. The dating of the faunal remains (Woodman *et al.* 1997; Woodman 2009, 197), however, along with a re-consideration of the cultural material (Leon 2005), has indicated that there was activity on the island over a period of up to 4000 years from before 6000 cal BC down into the fourth millennium cal BC and beyond (Woodman *et al.* 1997, 137–8). The midden appears to have been the result of repeated visits to the island, and might have been subject to disturbance. In terms of the discussion of the date of the early occurrence of domesticated animal species, the two relevant dates from Dalkey are for sheep (Fig. 12.42: OxA-4566) and cattle (Fig. 12.42: OxA-4571). Falling in the first half of the fourth millennium cal BC, these no longer seem to represent an early introduction of domesticates, since, by the time these animals died, other elements of the Neolithic were already in place in Ireland.

Similar persistence of place is apparent from a culturally Mesolithic site at Derragh, on the shore of Lough Kinale, Co. Longford, where occupation on a man-made platform is described as dating from around 5500 cal BC (Fredengren 2007; 2009; 2010, 241). The site consists of layers of stone, brushwood, peat and habitation debris. There is a large assemblage of late Mesolithic lithics and worked wood, but occupation, including the presence of domesticated fauna, continued into the early fourth millennium cal BC (Fredengren 2010, 248).

From the south side of the estuary of the R. Shannon at Carrigdirty Rock 5, Co. Limerick, a waterlogged basket woven from alder shoots has been dated to the fourth millennium cal BC by Beta-102087 and GrA-6520; a human skull fragment from the same context was dated by Beta-102086 (Fig. 12.42; Table 12.9). Other material was associated with this find, including other worked wood, a small schist axehead, chert flakes, possible hammerstones, hazelnuts – and cattle bones. The scatter has been interpreted as reflecting ephemeral occupation in a probably estuarine, wetland setting (A. O'Sullivan 2001).

A sequence of activity from the Mesolithic to the Neolithic was revealed at Clowanstown 1, Co. Meath (E. O'Connor 2008). Here a low rise at the edge of a lake was used as the base for a small timber platform or structure. Finds included a cache of Later Mesolithic butt-trimmed flakes. In a hollow in the lakebed nearby there were a series of fish-baskets which provided later sixth and earlier fifth millennium BC radiocarbon dates.[13] Activity was renewed in the early Neolithic after the lake had infilled with peat. A series of mounds, the largest over the former hollow, were constructed of layers of burnt material, including cremated animal bone and redeposited lake marl (see Breen 2003 for comparable mounds at Cherryville, Co. Kildare). Finds included Carinated Bowl and burnt flint. All the mounds were sealed with a layer of unburnt stone including artefacts. A wooden container (alder) deposited in the centre of the main mound provided a date of 3710–3630 cal BC (95% confidence; 4880±40 BP; Beta-237056), and the fill of a second wooden container from the same mound provided a date of 3970–3710 cal BC (95% confidence; 5060±40 BP; Beta-237055).

The form of models for the early Neolithic and the beginning of the middle Neolithic

This discussion of introduced animal species concludes our review of radiocarbon dates relating to the early Neolithic in Ireland. We have defined this archaeological phase as encompassing houses, and other occupation and activity associated with diagnostic early Neolithic material culture. Provisionally the construction of at least certain classes of monument may also fall within this phase, including portal tombs, court tombs and other forms. The construction and use of early stone-walled field systems may also fall into this period.

As described earlier in this chapter (and more fully in Chapter 2.2), in order to counteract the statistical scatter of radiocarbon dates from an archaeological phase, it is necessary to impose a statistical distribution on the period. This demands that the end as well as the beginning of the early Neolithic in Ireland be defined. Defining what constitutes the beginning of the Neolithic in Ireland – and elsewhere – has not only been the focus of prolonged debate but has remained difficult. Defining what constitutes the end of the early Neolithic has attracted far less attention, although the methodology employed in this volume demands an ending if the introduction of Neolithic practices is to be dated accurately (Bayliss *et al*. 2007a).

Changes in material culture and classes of monument have, however, regularly been thought of as serving to mark out a middle phase of the Neolithic in Ireland. Although much of what is taken as characteristic of the early Neolithic remained current, innovations include Linkardstown burials and passage tombs; the development of decorated globular bowls, such as Carrowkeel and Goodland forms; and the manufacture of mushroom-headed bone or antler pins and beads (for general characteristics of the Middle Neolithic, see Sheridan 1995; Cooney 2000a). It can be debated whether or not this archaeological transition has any relation to the lived experience of Neolithic people. It could be argued, on the one hand, that changes may have been introduced so gradually that any one generation would scarcely have been able to perceive difference from what had gone before, and on the other, that material culture in general relies so much on non-discursive meanings that no one generation would have had to confront explicit reckoning of the significance of material changes. The question of the rate and coincidence of changes is a very real one, and some authors have strongly argued, for example, that there are early forms of passage tomb (e.g. Burenhult 2001; 2003; Sheridan 2003b). It seems unlikely, however, that people would have been unaware of the combination of changes in material culture and the architecture of monuments, especially as both Linkardstown burials and passage tombs involved different kinds of building, access and experience, and because repeated deposits of consistent selections of material culture were placed in them. On this basis, we believe that a case can be made for a meaningfully constituted middle Neolithic in Ireland, certainly as far as is required to provide a limit for the dating of the early Neolithic practices in Ireland.

So, for the purposes of this chapter, we only consider the middle Neolithic in Ireland as providing a *terminus ante quem* for the end of the early Neolithic, and our treatment of components of the middle Neolithic has been much more selective than for the early Neolithic. A sequence which suggests that Linkardstown burials are earlier than passage tombs (at least for the sample for which we currently have radiocarbon dates) is included in all the models for the chronology of the early Neolithic in Ireland which we present here. The available radiocarbon dates are in good agreement with this interpretation. The results of these models are, however, practically identical if Linkardstown burials and passage tombs are modelled as independent, potentially overlapping, phases of activity. So for the

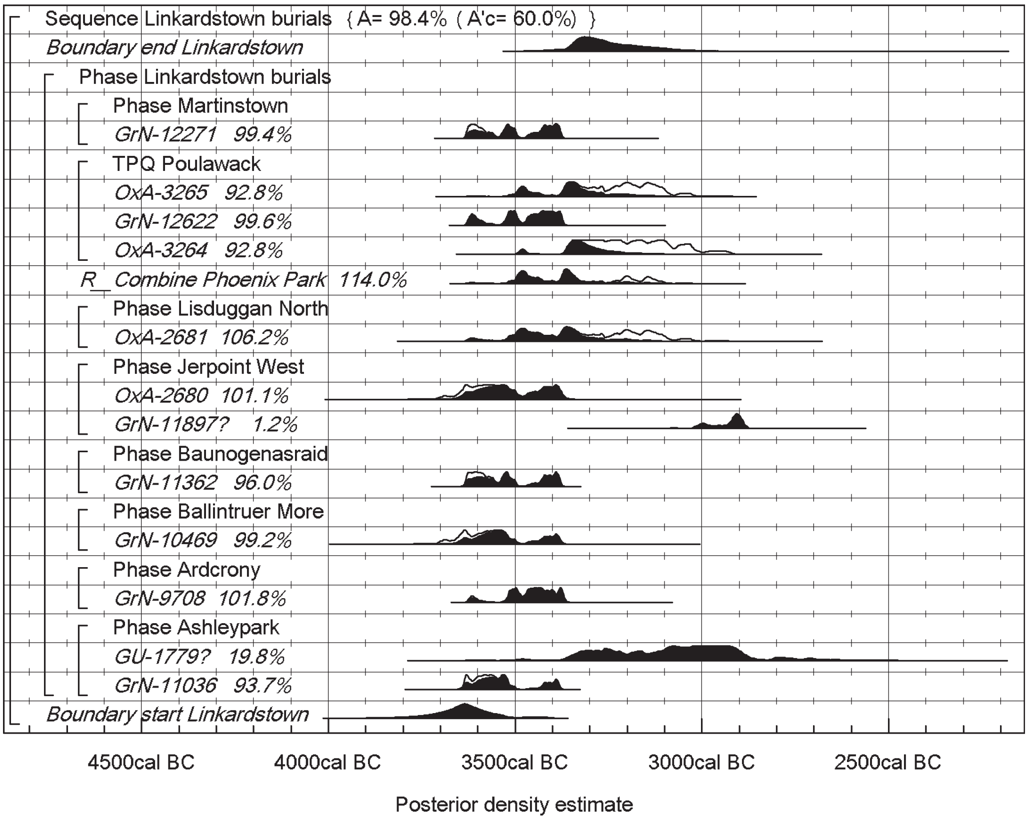

Fig. 12.44. Linkardstown burials. Probability distributions of dates. The format is identical to that of Fig. 12.6. The large square brackets down the left-hand side, along with the OxCal keywords, define the overall model exactly.

purposes of the models for the chronology of the early Neolithic in Ireland presented here, this interpretation is robust. It is not, however, based on stratigraphic evidence, and if the chronology of the middle Neolithic were the purpose of the study, this reading would certainly warrant further investigation.

Linkardstown burials

This group of inhumations in cists, accompanied by highly decorated bowls and generally under round mounds, has a distribution focussed in Munster and south Leinster (Herity 1982; Ryan 1981; Brindley and Lanting 1990; Sheridan 1995). A dozen examples have been excavated (Cooney 2000a), and they have been the subject of a dating programme (Brindley and Lanting 1990). The available measurements cover a large proportion of the known members of the class, but the samples were of variable integrity, and at least one, from Poulawack, Co. Clare (Table 12.11: GrN-12622), may have included bones from more than one individual. Others were disarticulated bones, from individuals who may have been dead for some time before their bones were deposited.

A femur from a disarticulated adult male skeleton was dated (Fig. 12.44: *GrN-11036*) from Ashleypark, Co. Tipperary (Manning 1985). Although disarticulated, the skeleton was more or less complete, so the individual was probably only recently dead when buried. A second measurement on cattle bones (GU-1779) from among the cairn stones of the outer part of the burial mound could relate to later activity on the site and has been excluded from the model.

A femur was dated (*GrN-9708*) from the younger of two disturbed, disarticulated but probably largely complete inhumations from the cist at Ardcrony, Co. Tipperary; a decorated bipartite bowl was placed between them in the middle of the cist (Wallace 1977).

Radiocarbon dates are available from the disarticulated bones of an adult male from Ballintruer More, Co. Wicklow (*GrN-10469*; J. Raftery 1973), and from a pile of disarticulated bones from a single individual from a cist at Baunogenasraid, Co. Carlow (*GrN-11362*; B. Raftery 1974). The former individual probably died shortly before burial, as most of the skeleton was represented. At Baunogenasraid, the bones were of a single individual. Although most of the small bones were missing, this loss can be accounted for by the soil conditions of the site (B. Raftery 1974, 283–4).

Two statistically inconsistent radiocarbon determinations (Table 12.11) are available from an articulated inhumation in the central cist at Jerpoint West, Co. Kilkenny (Ryan 1973; Herity 1982). The AMS determination (*OxA-2680*) is significantly earlier, and GrN-11897 appears to be aberrant, for reasons that are not clear (Brindley and Lanting 1990, 3). For this reason it has been excluded from the model.

Another date is available from an inhumation at Lisduggan North, Co. Cork, recorded in the 1940s (*OxA-2681*; Brindley and Lanting 1990, 2). It is not certain

Table 12.11. Radiocarbon dates for Linkardstown and related burials in Ireland. Posterior density estimates derive from the model defined in Fig. 12.44.

Laboratory number	**Sample reference**	**Material**	**Context**	**Radiocarbon age (BP)**	**$\delta^{13}C$ (‰)**	**Weighted mean (BP)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***
Ashleypark, Co. Tipperary								
GU-1779		Cattle. Bone	Sample of cattle bones from among the cairn stones of outer part of burial mound, (Manning 1985, 69, fig. 6). Could post-date burial (Brindley and Lanting 1990)	4385±110	−20.4		3370–2700	
GrN-11036		Human. Femur of disarticulated adult male skeleton	More or less complete in one place in stone cist with disarticulated child and sherds of 1 plain Carinated Bowl bowl, 1 decorated, bipartite style bowl, 1 Goodland style bowl. Second child and animal bone immediately outside cist (Manning 1985, 68, fig. 3; Brindley and Lanting 1990)	4765±40	−21.5		3650–3370	*3640–3495* (*75%*) or *3435–3375* (*20%*)
Ardcrony, Co. Tipperary								
GrN-9708		Human. Femur from disarticulated bones of 17–18 year-old youth	Disarticulated bones of 17–18 year-old youth on W side of polygonal cist under mound, directly on paving, disturbed bones of older man on thin layer of silt on E side, decorated, bipartite style bowl in centre, between them. Excavators concluded that bones could not have reached their final positions if articulated; they were, however, kept separate from each other and each individual was well represented, including finger and toe bones, so that they would not have been long out of articulation (Wallace 1977; Brindley *et al.* 1983; Brindley and Lanting 1990, 2)	4675±35	−21.2		3630–3360	*3625–3600* (*3%*) or *3525–3365* (*92%*)
Ballintruer More, Co. Wicklow								
GrN-10469		Human. Bone from probable adult '30 to 40 pieces of adult skeleton (3–4 cm and 5–6 cm) probably male. Fairly large piece (22 cm) of shaft of tibia with a vertical post mortem crack and part of head which shows strong markings. Also part of sacrum, segments of which appear not to be completely fused. Pieces of innominate, fragments of long bones, axis and, of the skull, only fragments of maxilla, mandible and vault are present. Six teeth present which show moderate wear.' (J. Raftery 1973, 217)	In central polygonal cist under mound with decorated, bipartite style bowl, '. . . the remains of one individual. The grave had been rifled by vandals on the night of its discovery so that the bones were broken and mixed but all the evidence indicates that they had been deposited originally in a disarticulated position and were also broken before burial. There is, for example, no suggestion from any source that a complete skull had existed when the grave was first opened.' (J. Raftery 1973, 217).(J. Raftery 1973; Brindley *et al.* 1983; Brindley and Lanting 1990)	4800±70	−21.6		3710–3370	*3660–3490* (*68%*) or *3470–3370* (*27%*)

Baunogenasraid, Co. Carlow								
GrN-11362		Human. Bone from disarticulated inhumation of single adult male, most of skeleton represented, several teeth, only a few toe bones and rib fragments	Piled in one corner of polygonal cist under mound with 2 decorated, bipartite style bowls, lignite toggle, bone point (B. Raftery 1974; Brindley and Lanting 1990, 1)	4735±35	−21.2		3640–3370	*3635–3495* (*59%*) or *3455–3375* (*36%*)
Jerpoint West, Co. Kilkenny								
GrN-11897		Human. Inhumed bone from articulated inhumation of young adult male	Inhumation and cremation in central polygonal cist associated with decorated, bipartite style bowl, sherd of plain shouldered bowl, bone pin (M. Ryan 1973; Herity 1982, 298–9, fig. 24:1–4; Brindley and Lanting 1990)	4305±40	−21.9	4404±63 T'= 27.9; T'(5%)=3.8; ν=1	3020–2870	
OxA-2680	NMI E93:15	Replicate of GrN-11897	From the same context as GrN-11897 (R. Hedges *et al.* 1993)	4770±80	−21.9		3710–3360	*3645–3365*
Lisduggan North, Co. Cork								
OxA-2681	IA/500/47	Human bone	Inhumation and fragment of decorated, bipartite style bowl, collected in 1940s. No further information (Brindley and Lanting 1990, 2; R. Hedges *et al.* 1993)	4585±80	−23.3		3630–3020	*3630–3580* (*3%*) or *3535–3170* (*92%*)
Phoenix Park, Dublin								
OxA-2678	NMI W3	Human bone, unspecified, from one of 2 articulated adult male skeletons	2 articulated inhumations and small amount of bone from 3rd individual in cist under mound with shell necklace and bone object (Wilde 1857, 180–3; Herity 1982, 297, fig. 24: 5–6; Brindley and Lanting 1990; R. Hedges *et al.* 1993)	4650±70	−22.4	4594±53 T'=1.5; T'(5%)=3.8; ν=1	3520–3100	*3525–3260* (*92%*) or *3220–3180* (*3%*)
GrA-10970		Human. Carbonate from unburnt bone. Experimental replicate of OxA-2678	From the same context as OxA-2678 (Lanting and Brindley 1998)	4520±80				
Poulawack, Co. Clare								
GrN-12622		Human. From among disarticulated bones of middle-aged male and female, young adult female and infant. Probably a mixture of the bones of the 3 adults (Brindley and Lanting 1992, 13)	Grave 8/8a. Polygonal subdivided cist built on ground surface under cairn, accompanied by hollow scraper, boar tusk, 2 indeterminate sherds. Compartment 8A measured 0.70 m x 0.40 m x up to 0.90 m deep and contained scattered bones, a boar tusk and a flint hollow scraper. Compartment 8 measured 0.95 m x 0.40–0.50 m x 0.90 m deep and contained the disarticulated remains of the 4 individuals. Cairn enlarged and used for burial in early Bronze Age (Hencken 1935; M. Ryan 1981; Brindley and Lanting 1992)	4695±35	−22.1		3640–3360	*3630–3580* (*16%*) or *3535–3365* (*79%*)
OxA-3264	Poulawack 8/8a	Human. Single bone from different adult to that dated by OxA-3265	From the same context as GrN-12622 (Brindley and Lanting 1992; R. Hedges *et al.* 1993)	4485±60	−21.0 (assumed)		3370–2920	*3500–3450* (*8%*) or *3375–3135* (*87%*)
OxA-3265	Poulawack 8/8a (2)	Human. Single bone from different adult to that dated by OxA-3264	From the same context as GrN-12622	4550±65	−21.0 (assumed)		3500–3020	*3520–3395* (*28%*) or *3385–3165* (*66%*) or *3160–3140* (*1%*)
Martinstown, Co. Meath								
GrN-12271		Human. Bone	Skeleton in pit associated with decorated, bipartite style bowl and lignite fragment (Hartnett 1951; Brindley and Lanting 1990)	4720±35	−21.9		3640–3370	*3635–3555* (*25%*) or *3540–3490* (*22%*) or *3470–3370* (*48%*)

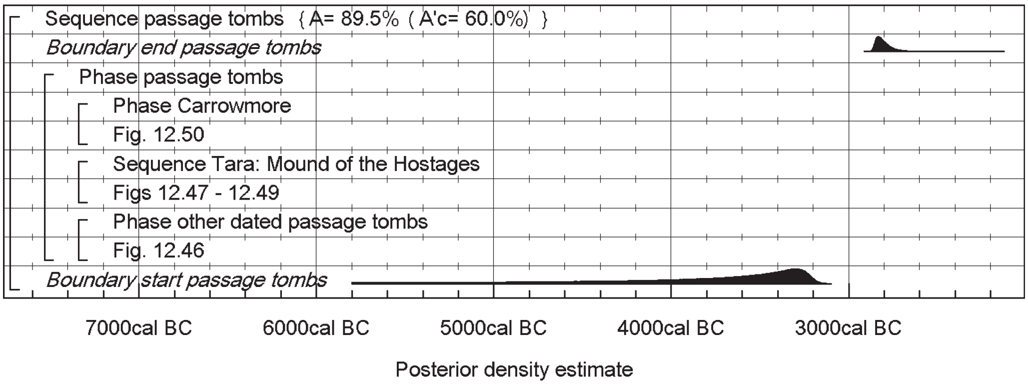

Fig. 12.45. Passage tombs. Overall structure of the chronological model. The component sections of this model are shown in detail in Figs 12.46–50. The large square brackets down the left-hand side of Figs 12.45–50, along with the OxCal keywords, define the overall model exactly.

whether this sample was from an articulated skeleton. Two statistically consistent measurements (Table 12.11: OxA-2678, GrA-10970) are also available from one of two articulated adult male skeletons found with a shell necklace and bone object in a cist under a mound at Phoenix Park, Dublin (Fig. 12.44: *Phoenix Park*: Wilde 1857, 180–3).

From Poulawack, Co. Clare (Hencken 1935), three dates are available from disarticulated bones. These provide *termini post quos* for the central burial. Although the sample for *GrN-12622* probably consisted of a mixture of bones from the adults in the cist, the date still provides a reliable *terminus post quem* for the last interment in the central cist. Fragile bones such as scapulae, pelves and vertebrae were well preserved in this deposit, but small bones were absent and crania slightly over-represented, suggesting that the remains of well preserved skeletons had been gathered up and placed in the cist (Beckett and Robb 2006, 63). *GrN-12271* provides a date from a skeleton associated with a decorated bipartite bowl from Martinstown, Co. Meath (Hartnett 1951).

The model for the currency of Linkardstown burials is shown in Fig. 12.44. Initially, this has been calculated without reference to the assumption that this tradition follows on from the early Neolithic. This model suggests that Linkardstown burials began in *3835–3500 cal BC* (*90% probability*; Fig. 12.44: *start Linkardstown*) or *3490–3410 cal BC* (*5% probability*), probably in *3710–3560 cal BC* (*68% probability*). It ended in *3425–3015 cal BC* (*95% probability*; Fig. 12.44: *end Linkardstown*), probably in *3355–3180 cal BC* (*68% probability*). These estimates are relatively imprecise because of the limited number of burials dated. Greater precision would require either site-specific dating of series of related samples (if available in archive) or the dating of a substantial number of further primary burials (which are not available in archive).[14]

Passage tombs

Passage tombs have long been excavated and analysed. The most extensive campaigns of the twentieth century were those of Michael J. O'Kelly at Newgrange and of George Eogan at Knowth, both in Brú na Bóinne or the Bend of the Boyne in Co. Meath (O'Kelly 1982; Eogan 1984; Eogan 1991; Eogan and Roche 1997), and those of Goran Burenhult at Carrowmore, in Co. Sligo (Burenhult 1980; 1984; 2001; 2003). A signal landmark is the recent publication by Muiris O'Sullivan (2005) of excavations at the Mound of the Hostages at Tara conducted by Seán P. Ó Ríordáin and Ruaidhrí de Valera in the 1950s. These monuments have long been recognised as linked by shared traditions of form, ritual, contents and imagery; their artefact repertoire places them after the early Neolithic, a chronological position emphasised by the construction of passage tombs over existing early Neolithic occupation at Knowth and Newgrange. Burenhult's assertion, based on radiocarbon dates obtained during the first years of his investigations at Carrowmore, that the passage tomb cemetery there had possibly Mesolithic origins (1980, 111–13; 1984) prompted contention and disbelief (Caulfield 1983, 206–3; Bergh 1995, 99–106; Woodman 2000, 234–5; Grogan 1991; Sheridan 2003a; and see Chapter 1.5). Some authors, however, have argued for the dating of closed polygonal chambers and simple passage tombs in Ireland to around 4000 cal BC (e.g. Sheridan 2003b; 2004; 2005; 2007a).

Dates from passage tombs are listed in Table 12.12. The overall form of the model for the chronology of passage tombs is shown in Fig. 12.45, with component sections relating to Townleyhall, Knowth, Newgrange and Carrowkeel given in Fig. 12.46, the component model for The Mound of the Hostages, Tara, in Figs 12.47–9, and the component for Carrowmore in Fig. 12.50. As for Linkardstown burials, initially the chronology of passage tombs has been modelled independently of their relationship to the early Neolithic. The Mound of the Hostages has been treated separately with a continuous phase of use incorporated into the model for that site alone. This means that in the overall model for passage tombs, only the start and end dates for The Mound of the Hostages are effective. This avoids the domination of the output of the model by the overwhelming number of dates from this single site. This is only partially successful, however, because no other

Table 12.12. Radiocarbon dates for passage tombs in Ireland. Posterior density estimates derive from the model defined in Figs 12.45–50.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Townleyhall II, Co. Louth									
BM-170		Charcoal (unidentified)	Habitation layer beneath passage tomb	4680±150				3770–2930	*3765–3010*
Knowth I, Co. Meath									
UB-357	Samples 4 and 5, combined	Charcoal (unidentified)	Cuttings 29/30 and 36. Basal sod layer of mound	4745±165				3940–3020	*3940–3855* (*3%*) or *3820–3080* (*91%*) or *3070–3025* (*1%*)
UB-358	Sample 5	Humic acid	Cutting 36. Basal sod layer of mound	6835±110				5990–5550	
OxA-7786	UB-4090	Charcoal (unidentified)	Basal structural layer (Bronk Ramsey *et al.* 2002). Sample did not produce enough gas for LSC in Belfast. CO_2 graphitised and measured in Oxford	4890±40	−19.9			3760–3630	*3770–3630*
GrN-12357		Charcoal	From mound (Grogan 1991, 130; Bergh 1995)	4405±35				3310–2910	*3315–3270* (*2%*) or *3265–3235* (*4%*) or *3110–2910* (*89%*)
GrN-12827	Knowth 1984	Charcoal (unidentified)	Scattered fragments in sod layer at base of large mound below orthostat 75 of eastern tomb, possibly dates construction, Knowth 1	4465±40	−27.1			3350-2940	*3350–3010*
GrN-12358	Knowth 1983–4	Charcoal (unidentified)	Spread on old land surface beneath mound	4490±60	−25.1			3370–2920	*3365–3005* (*94%*) or *2980–2955* (*1%*)
Knowth 2, Co. Meath									
BM-785	Sample 3/1967	Charcoal (unidentified)	Spread of charcoal in mound, close to disturbed area with small amount of Beaker pottery (Grogan 1991, 129)	4158±126				3080–2450	
Knowth 9, Co. Meath									
GrN-11714[1]		Charcoal (unidentified)	Cremation deposit in end recess	4420±50				3340–2900	*3335–3210* (*23%*) or *3190–3150* (*5%*) or *3135–2910* (*67%*)
Knowth 16, Co. Meath									
BM-1078	Sample 4/1973	Charcoal (unidentified)	Spread sealed in mound of smaller tomb pre-dating main tomb (Eogan 1986, 83)	4399±67				3350–2890	*3335–3210* (*20%*) or *3190–3150* (*5%*) or *3140–2895* (*70%*)
Knowth 17, Co. Meath									
UB-318		Charcoal (unidentified)	Thin layer of dark material under mound	4873±150				3980–3350	*3995–3345*
UB-319		Charcoal (unidentified)	From the same context as UB-318	4797±185				3970–3020	*3970–3080*
Newgrange, Co. Meath									
GrN-5462-C	Sample 1	10.3 g of charcoal fragments from small twigs (organic fraction measured)	Soil caulking of roof slab 3 of passage, which could have been put in place only at time of construction (O'Kelly 1969), corrected from GrN-5462 (4500±45 BP) by O'Kelly (1972)	4425±45	−26.0			3340–2910	*3335–3210* (*25%*) or *3190–3155* (*4%*) or *3130–2915* (*66%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	δ^{13}C (‰)	δ^{15}N (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrN-5463	Sample 2	20 g of charcoal fragments from small twigs (organic fraction measured)	Soil caulking from under cross-lintel supporting boulder cap at junction of passage roof and chamber, which could have been put in place only at time of construction (O'Kelly 1969)	4415±40	−24.8			3330–2910	*3330–3230* (*15%*) or *3175–3155* (*2%*) or *3120–2915* (*78%*)
UB-360		Humic acid	Upper sod layer in mound, 0.60 to 0.90 above old ground surface	2250±45				400–190	
UB-361		Humic acid	Basal sod layer in mound, 0.05 to 0.20 m above old ground surface	4535±105				3630–2910	*3520–2920*
GrN-9057	Newgrange 6	Turves (described as peat by lab; organic fraction measured)	Sods possibly redeposited from structure predating main tomb	4480±60	−28.5			3370–2920	*3360–3005* (*92%*) or *2985–2935* (*3%*)
Mound of the Hostages, Tara, Co. Meath									
Pre-cairn									
D-42		Charcoal (unidentified)	Infill of pre-cairn ditch, but from beyond cairn (McAulay and Watts 1961; Newman 1997, 146; M. O'Sullivan 2005, 26)	4080±160					
GrA-17674	Sample 14	*Corylus* charcoal	Pre-cairn ditch, but from beyond cairn (M. O'Sullivan 2005, 27)	4525±40				3370–3090	*3365–3165*
GrN-26065	Sample 10	Unidentified charcoal fragments from sample in which all identified fragments *Corylus*	Pre-cairn ditch, but from beyond cairn (M. O'Sullivan 2005, 27)	4550±90				3630–2920	*3525–3155*
GrA-17676	Sample 9	*Corylus* charcoal	Pre-cairn ditch, Cutting L – near south edge of cutting 1959, actually sealed by cairn (M. O'Sullivan 2005, 27)	4485±40				3360–3020	*3350–3170*
D-44		Charcoal (unidentified)	Fire 3 or fire 4. Probably from horizon containing charcoal and burnt soil sealed by upcast from trench for orthostats of tomb; on old ground surface close to entry to passage (McAulay and Watts 1961; M. O'Sullivan 2005, 27–8, 63–5, fig. 19). Considered too recent by O'Sullivan	3880±150				2880–1920	
GrA-17675	Sample 11	*Quercus* charcoal	Fire 1. On flat stones, under cairn (M. O'Sullivan 2005, 27)	4900±50				3790–3540	*3795–3630* (*93%*) or *3555–3535* (*2%*)
D-43		Charcoal (unidentified)	Burnt ground surface under cairn (McAulay and Watts 1961; 7). Considered too recent by M. O'Sullivan (2005, 28)	4260±160					
GrA-17525	Sample 6	*Corylus* charcoal	Old ground surface under cairn at E edge of NE quadrant, 1959 (M. O'Sullivan 2005, 28)	4555±45				3500–3090	*3495–3460* (*7%*) or *3380–3165* (*88%*)
GrN-26064	Sample 8	Unidentified charcoal fragments from sample in which all identified fragments *Corylus*	Under cairn, NE quadrant 1959 (M. O'Sullivan 2005, 28)	4840±80				3790–3370	*3790–3495* (*86%*) or *3455–3375* (*9%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Passage tomb									
GrA-17114	Sample 15	Human. Cremated bone	Fill of foundation trench dug into pre-tomb surface behind tomb backstone (M. O'Sullivan 2005, 63, 119, fig. 58)	4420±50				3340–2900	*3350–3210*
GrA-17274	Sample 43	Human. Cremated bone	Cremation in cist I. Sample taken from basal cleaning of cist. Under cairn, against exterior of chamber, on old land surface, coinciding with gap between orthostats, containing cremated remains of at least 8 individuals, unburnt infant and child bones, bone pins, tubular bone bead, biconical stone bead, Carrowkeel bowl, acorn husks and small animal bones (M. O'Sullivan 2005, 63–6, 69, figs 59, 61, 64–6)	4385±35				3270–2900	*3095–2915*
GrA-17272	Sample 44	Human. Cremated bone	Cremation in cist II. Under cairn, against exterior of N side of chamber, on old land surface, coinciding with gap between orthostats, containing cremated bones of at least 34 individuals, with some spillage from tomb fill including cremated bone, 3 or 4 unburnt adult skulls and infant bones. Sample taken from main fill of cist, but may have consisted of part of spillage from tomb. Also flint flake, stone bead, stone balls, bone pins, bone tubes, sherd (M. O'Sullivan 2005, 70–4, figs 59, 67–72)	4180±35			4187±29 T'=0.1; T'(5%)=3.8); ν=1	2890–2660	*2895–2835*
GrA-17746	Sample 44*	Replicate of GrA-17272	From the same cremation deposit as GrA-17272	4200±50					
GrA-17747	Sample 45*	Human. Cremated bone	Cremation in cist III. Under cairn, against W side of S portal slab, in bedding trench for tomb orthostats, in gap between two orthostats, but isolated from tomb by its own slabs. Cremated and some unburnt bone of at least 3 adults in and around in a Carrowkeel Bowl lay on further cremated and unburnt bone of at least 5 adults and 1 child which lay on floor. Deposit including bowl overlain by silted clay. Also present were decorated bone pendants, stone beads, bone bead, bone and antler pins. Sample taken from in and under Carrowkeel bowl (M. O'Sullivan 2005, 75–9, figs 59, 73–8)	4530±60				3500–3020	*3275–3130*
GrA-17277	Sample 50	Human. Cremated bone	Inner compartment of tomb. Main cremation deposit, near large slab at sill stone 3, entering inner compartment of tomb. Mass of cremated bone from numerous individuals with some unburnt bone, disturbed by digging of pit for EBA inhumations 18 and 19, containing hammer pendant, mushroom-headed pin, sherds of Carrowkeel bowl (M. O'Sullivan 2005, 103–13, figs 100–110)	4390±35				3270–2900	*3095–2915*
GrA-17743	Sample 54	Human. Cremated bone	Gap between orthostat L1 and decorated orthostat L2 (M. O'Sullivan 2005, 119, fig. 58)	4480±50				3370–2930	*3250–3005* (90%) or *2985–2930* (5%)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
GrA-17678	Sample 65	Human. Unburnt, disarticulated bone	Deposit XLIX. Stony layer across passage in vicinity of sill stone 2, 1.2 m from east capstone, containing disarticulated unburnt bone from at least 11 individuals (1 of them ??more or less articulated), cremated bone from at least 5, bone pins, stone balls (M. O'Sullivan 2005, 100–103; fig. 97)	4390±45	−22.5	11.65		3310–2900	*3110–2900*
GrA-17669	Sample 66	Human. Unburnt, disarticulated bone	From the same context as GrA-17678, 1.2 m from east capstone	4415±40	−22.0			3330–2910	*3185–3155* (*2%*) or *3130–2910* (*93%*)
GrA-17668	Sample 67	Human. Unburnt, disarticulated bone	From the same context as GrA-17678. Junction of L1 and L2 near skull 4, 1.50 m depth from E end of capstone. Layer 2	4355±40	−22.3	11.43		3100–2890	*3090–3055* (*9%*) or *3035–2895* (*86%*)
GrA-17749	Sample 68	Human. Cremated bone	From the same context as GrA-17678. 1.20 m depth from E capstone, layer 1	4410±50				3340–2900	*3190–3150* (*4%*) or *3140–2900* (*91%*)
GrA-17682	Sample 70	Human. Unburnt bone	Deposit XXXVIII. Context problematical. Scatter of burnt and unburnt human bone close to fragments of two bowl Food Vessels against face of orthostat L2 in chamber (Brindley *et al.* 2005, 286; M. O'Sullivan 2005, 96–7, fig. 94)	4370±40	−22.3	11.57		3100–2890	*3090–2905*
GrA-18352	Sample 80	Human. Skull	Middle compartment. Skull 4, one of group of skulls between orthostat R2 and sill stone 2, in main cremation deposit on base, (M. O'Sullivan 2005, 113–16)	4370±50	−21.9	11.80		3270–2890	*3100–2895*
GrA-18353	Sample 81	Human. Skull	Middle compartment, Skull P. Unburnt adult cranium from group of skulls in main cremation deposit on base, in gap between sill stone 2 and orthostat R2, surrounded by calcined bone fragments (M. O'Sullivan 2005, 113–16)	4060±50	−22.1			2870–2470	*2880–2815*
GrA-18374	Sample 82	Human. Skull	Middle compartment, skull g (unburnt, probably adolescent or child). One of group of skulls between orthostat R2 and sill stone 2, in main cremation deposit on base; other disarticulated unburnt bones also present (M. O'Sullivan 2005, 113–16)	4230±50	−22.4	9.72		2920–2670	*3010–2985* (*1%*) or *2930–2830* (*94%*)
Perimeter burials									
GrA-17296	Sample 19	Human. Cremated bone	Burial 15. Cremated bone in stones, perimeter, overlying pre-cairn ditch, probably covered by earthen mound (M. O'Sullivan 2005, 31, 38, fig. 19)	4485±35				3360–3020	*3220–3020*
GrA-17295	Sample 20	Human. Cremated bone	Burial 2. Cremated bone associated with stone setting, perimeter, within limit of earthen mound (M. O'Sullivan 2005, 33, figs 19, 24, 25)	4550±50				3500–3090	*3220–3085* (*91%*) *3460* or *3065–3025* (*4%*)
GrA-17117	Sample 21	Human. Cremated bone	Burial 13. Cremated bone in stone setting, with fragmentary bone pin, perimeter, within limit of earthen mound (M. O'Sullivan 2005, 36, figs 19, 32, 55: 197)	4510±50				3370–3020	*3230–3015*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-17297	Sample 22	Human. Cremated bone	Burial 14. Comminuted cremated bone in stone setting, perimeter, outside limit of earthen mound (M. O'Sullivan 2005, 37, figs 19, 33, 34)	4515±35				3370–3090	*3215–3085* (*92%*) or *3060–3030* (*3%*)
GrA-17156	Sample 23	Human. Cremated bone	Burial 11. Small amount of ?human cremated bone, perimeter, outside limit of earthen mound (M. O'Sullivan 2005, 36)	4440±60				3360–2900	*3185–2915*
GrA-17157	Sample 24	Human. Cremated bone	Burial 4. Small amount of cremated bone with charcoal, perimeter, beneath yellow soil of mound (M. O'Sullivan 2005, 34, figs 19, 27)	4480±60				3370–2920	*3200–2925*
GrA-17158	Sample 25	Human. Cremated bone	Burial 9. Cremated bone with stone setting, perimeter, outside edge of earthen mound (M. O'Sullivan 2005, 35–6, fig. 31)	4470±70				3370–2910	*3195–2915*
GrA-17324	Sample 38	Human. Cremated bone	Burial 6. Small amount of cremated bone in stone setting, perimeter (M. O'Sullivan 2005, 35, fig. 29)	4530±35				3370–3090	*3220–3090*
GrA-17325	Sample 40	Human. Cremated bone	Burial 3. Cremated bone in stone setting, perimeter, within limit of earthen mound (M. O'Sullivan 2005, 33–4, figs 19, 26)	4470±35				3350–3010	*3225–3205* (*1%*) or *3200–3010* (*94%*)
GrA-17202	Sample 41	Human. Cremated bone	Burial 16. Cremated bone under shale slab, perimeter, about 9m west of mound (M. O'Sullivan 2005, 31, 38)	4460±60				3370–2910	*3190–2920*
GrA-17201	Sample 39	Human. Cremated bone	Burial 17. 3 scatters of cremated bone, some of it on large stone, perimeter, outside limit of mound (M. O'Sullivan 2005, 39, fig. 35)	4450±60				3360–2910	*3190–2915*
EBA burials in tomb and chamber									
GrA-17719	Sample 51	Human. Cremated bone	Inner compartment of tomb. Level of burial 18 (which was associated with a Food Vessel, a V-perforated button and a Copper alloy awl and lay in base of pit cut into floor of chamber (M. O'Sullivan 2005, 109–12, figs 100, 104)	3760±50				2340–2020	
GrA-18350	Sample 55	Human. Skull	Inner compartment of tomb. SE of chamber, main cremation deposit, context of GrA-17277 (M. O'Sullivan 2005, 111–12, figs 100–110). Seen by O'Sullivan as resulting from disturbance in course of insertion of EBA burials	3760±50	−22.0			2340–2020	
GrA-17680	Sample 62	Human. Inhumed bone	Inner compartment of tomb. Unspecified inhumation 'from basin in chamber' (M. O'Sullivan 2005, 103–12)	3665±35	−21.7			2150–1940	
GrA-17279	Sample 69	Human. Cremated bone	Burial 24. On S side of outer compartment, against orthostat L1, in cist. Cremation of 1 adult in inverted Encrusted Urn accompanied by vase Food Vessel, burnt flint knife, flint and ?chert flakes (M. O'Sullivan 2005, 90–4, figs 87–90)	3635±35				2140–1890	
EBA burials in mound									
GrA-17299	Sample 26	Human. Cremated bone	Burial 31. Cremation inserted into SE quadrant of mound, in cist, with 2 bone needles (M. O'Sullivan 2005, 182–3)	3475±35				1900–1690	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-17159	Sample 27	Human. Cremated bone	Burial 33. Cremation inserted into SE quadrant of mound. Small quantity of cremated bone beneath upright tripartite bowl Food Vessel (M. O'Sullivan 2005, 184–5)	3560±60				2120–1740	
GrA-17161	Sample 28	Human. Cremated bone	Burial 35. Cremation inserted into SE quadrant of mound beneath inverted enlarged Food Vessel and accompanied by inverted vase Food Vessel (M. O'Sullivan 2005, 186–90)	3470±60				1950–1620	
GrA-17162	Sample 29	Human. Cremated bone	Burial 34. Cremation inserted into SE quadrant of mound, within and around inverted Encrusted Urn, in cist (M. O'Sullivan 2005, 185–7)	3500±60				2020–1680	
GrA-17321	Sample 30	Human. Cremated bone	Burial 41. Cremation inserted into NE quadrant of mound. Beneath inverted Collared Urn with heat-damaged copper alloy dagger (M. O'Sullivan 2005, 201–3)	3445±35				1890–1660	
GrA-17539	Sample 31	Human. Cremated bone	Burial 45. In NE quadrant of mound, in cist, in two masses, with copper alloy fragments, flint fragment, possibly bone pinhead (M. O'Sullivan 2005, 209–10)	3550±45				2030–1740	
GrA-17193	Sample 32	Human. Cremated bone	Burial 40. Spread of cremated bone with burnt flint knife, close to an inverted bowl Food Vessel and a vase Food Vessel, association uncertain (M. O'Sullivan 2005, 197–201)	3600±60				2140–1770	
GrA-17195	Sample 33	Human. Cremated bone	Burial 43. In SW quadrant of mound, cremation of at least 1 adult beneath Encrusted Urn A, one of two adjacent inverted Encrusted Urns accompanied by two inverted vase Food Vessels (M. O'Sullivan 2005, 204–7)	3570±60				2130–1740	
GrA-17276	Sample 47	Human. Cremated bone	Burial 43. In SW quadrant of mound, cremation of at least 2 adults and a child beneath Encrusted Urn B, one of two adjacent inverted Encrusted Urns accompanied by two inverted vase Food Vessels (M. O'Sullivan 2005, 204–7)	3640±35				2140–1900	
GrA-17198	Sample 35	Human. Cremated bone	Burial 39. Cremation inserted into SE quadrant of mound, beneath inverted enlarged Food vessel with warped copper alloy dagger, burnt bone pin fragment, perforated pumice stone (M. O'Sullivan 2005, 195–7)	3500±60				2020–1680	
GrA-17232	Sample 36	Human. Cremated bone	Burial 38. Cremation inserted into SE quadrant of mound, beneath inverted Collared Urn with bronze dagger and stone battle-axe, both burnt, accompanied by inverted vase Food Vessel (M. O'Sullivan 2005, 186–90)	3430±35				1880–1630	
GrA-17196	Sample 34	Human. Cremated bone	Burial 42. Cremation of one or possibly two individuals in cist inserted into SW quadrant of mound, under inverted enlarged Food Vessel beside inverted Collared Urn (M. O'Sullivan 2005, 203–5)	3500±60				2020–1680	

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
GrA-17199	Sample 37	Human. Cremated bone	Burial 42. Cremation under inverted Collared Urn with fragment of bone needle or pendant beside inverted enlarged Food Vessel in same cist as sample for GrA-17196. Impossible to tell if from a separate individual (M. O'Sullivan 2005, 203–5)	3410±60				1890–1530	
GrA-19180	Sample 83	Human. Articulated inhumation	Burial 30. Crouched inhumation inserted into NW quadrant of mound. Youth with bead necklace, including faience, amble jet, bone and copper alloy; razor near feet (M. O'Sullivan 2005, 177–82, figs 140–6)	3370±60	−21.5			1880–1500	
Miscellaneous features around perimeter									
GrN-26060	Sample 1	*Prunus spinosa* and *Corylus* charcoal	Pit F. Ash pit with some charcoal, at S edge of mound (M. O'Sullivan 2005, 43, fig. 19)	3480±50				1940–1680	
GrN-26061	Sample 2	*Corylus* charcoal	Pit O. Baulk between squares 14 and 15. Spread of charcoal, possibly in a shallow pit, perimeter, outside limit of mound (M. O'Sullivan 2005, 44, fig. 19)	3510±50				1960–1690	
GrN-26063	Sample 4	Mainly *Corylus* charcoal with some *Alnus*	Pit C. Square 26, pit containing dark soil and charcoal, perimeter, outside edge of mound (M. O'Sullivan 2005, 52, figs 15, 19)	3480±70				2010–1620	
GrA-17523	Sample 5	*Prunus spinosa* charcoal	Pit R. Square 66, pit containing dark soil, charcoal and burnt stones and/or clay, perimeter, outside limit of mound (M. O'Sullivan 2005, 45, fig. 19)	3610±50				2140–1780	
SE of mound									
GrN-26062	Sample 3	*Corylus* charcoal	Pit Z2. Square 35, perimeter, beyond south-east limit of mound, regarded as linked to palisade 3 (M. O'Sullivan 2005, 50–6, figs 19, 36, 47, 48)	3960±60				2620–2280	
GrA-17670	Sample 18	*Ulmus* charcoal	Palisade 2. Square 7, perimeter, north of mound (M. O'Sullivan 2005, 50, figs 19, 40, 47)	3925±40				2570–2290	
GrA-17113	Sample 12	Human. Cremated bone	Ring ditch beyond SE edge of mound. Small number of fragments of cremated bone, green bead and decayed sherds found together, perhaps at a lower level than sample for GrA-17294 (M. O'Sullivan 2005, 51–6)	2620±50					
GrA-17294	Sample 16	Human. Cremated bone	Cremation scatter on surface in interior of ring ditch, perhaps at a higher level than sample for GrA-17113 (M. O'Sullivan 2005, 53–6)	2255±30					
Mound									
GrA-17672	Sample 17	*Corylus* charcoal, *c.* 14 years old	From edge of cairn in original sod covering. May have been transported to site in turf (Brindley *et al.* 2005, 295)	4680±40				3630–3360	*3630–3585 (10%)* or *3530–3365 (85%)*
Carrowkeel M, Co. Sligo									
Ua-510	Sample 1	Human. Tooth	Between orthostats in end recess of passage grave, at different location to sample for Ua-511 (Bergh 1995, 105)	3770±100	−25.0			2480–1910	
Ua-511	Sample 2	Pomoideae (?) charcoal	Between orthostats in end recess, at different location to sample for Ua-510 (Bergh 1995, 105)	4530±100	−25.0			3630–2910	*3520–3420 (10%)* or *3385–2920 (85%)*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC)* (*95% probability*)
Croaghaun, Glen, Co. Sligo									
Ua-713	C14:2	*Pinus sylvestris* charcoal	*In situ* cremation deposit between and partly under first and second chamber orthostats on L side of chamber. Including cremated bone, charcoal, coarse pottery and head of poppy-headed bone or antler pin (Bergh 1995, 105, 225)	6680±100	−25.0			5740–5470	
St-10453	C14:3	*Pinus sylvestris* charcoal	Charcoal spread with cremated bones in outer part of chamber (Bergh 1995, 105, 225)	5685±85				4720–4340	
St-10452	C14:1	Charcoal (unidentified)	In rift on bedrock beneath cairn (Bergh 1995, 105, 225)	4680±675				5220–1820	
St-10454	C14:5	Charcoal (unidentified)	Bedrock beneath cairn (Bergh 1995, 105, 225)	3280±295				2350–820	
St-10455	C14:6	Charcoal (unidentified)	Bedrock beneath cairn (Bergh 1995, 105, 225)	2025±285				800 BC–610 AD	
Carrowmore 1, Co. Sligo									
Ua-16970	ID 60106	Charcoal	Tomb 1. Sample from close to inner stone circle found when tomb sectioned 1995–6 (Burenhult 2001, 18). From stone socket (Burenhult 2003, 67)	5320±8	−26.2			4340–3960	*4330–3985*
Carrowmore 4, Co. Sligo									
Ua-16975	20/94	Charcoal	Tomb 4. 3rd phase, when 2nd inner stone circle and 2 cists built (Burenhult 2001, 19)	4425±80	−26.9			3370–2890	*3340–2905*
Ua-16976	24/94	Charcoal	Tomb 4. 3rd phase, when 2nd inner stone circle and 2 cists built (Burenhult 2001, 19).	4390±70	−25.2			3340–2880	*3335–3210* (*19%*) or *3190–3150* (*4%*) or *3135–2890* (*72%*)
Ua-16972	14/94	Charcoal	Tomb 4. 3rd phase, when 2nd inner stone circle and 2 cists built (Burenhult 2001, 19)	4220±80	−26.0			3020–2570	*3085–3065* (*1%*) or *3030–2750* (*94%*)
Lu-1750	2:79	Charcoal	Tomb 4. Charcoal from just outside central stone packing (Bergh 1995, 102) or from secondary inner stone circle (Burenhult 1984, 131; Hakansson 1981). If this sample is that shown as ‘C14 test 2’ in Burenhult 1980, fig. 27, then Bergh’s description of the context seems more accurate and the date should be a *terminus post quem* for the more extensive stone packing surrounding the chamber, i.e. for a secondary state of construction. No pretreatment; small sample; diluted; 50% sample. (3 1-day counts) (Hakansson 1981, 400)	4320±75	−24.3			3270–2710	*3330–3225* (*6%*) or *3125–2855* (*89%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Lu-1840	4:79	Charcoal	Tomb 4. Charcoal from 'stone fundament to stone b in central cist'. Stone b was a large slab set in a bedding trench with others forming chamber of small passage Tomb. The sample came from a circumscribed concentration of charcoal in the soil at the base of the bedding trench, between the bases of two orthostats (Burenhult 1984, fig. 37). The contents of the chamber had been disturbed before excavation. It contained large amounts of displaced burnt human and animal bone and 4 fragmentary antler pins, more of which had been thrown out from the chamber (Burenhult 1980, 68–82; 1984, 128). The sample reference quoted here is that used by Burenhult (1984, 128). Previously, however, C14 sample 4-79 was attributed to Tomb 1 (Burenhult 1980, 47; Hakansson 1981)	5750±85	−30.2			4800–4370	*4795–4440* (*94%*) or *4425–4395* (*1%*)
Ua-16974	17/94	Charcoal	Tomb 4. 'May belong to' second phase, when passage and inner stone circle added (Burenhult 2001, 19). From stone socket (Burenhult 2003, 67)	5230±80	−25.6			4320–3800	*4265–3930* (*90%*) or *3875–3805* (*5%*)
Ua-13382	19/94	Charcoal?	Tomb 4. 'May belong to' second phase, when passage and inner stone circle added (Burenhult 2001, 19). From stone socket (Burenhult 2003, 67)	5180±90	−27.6			4240–3770	*4240–3770*
Ua-4486	7	*Corylus avellana* charcoal	Tomb 4. 'May belong to' second phase, when passage and inner stone circle added (Burenhult 2001, 19). From stone socket of passage (Burenhult 2003)	4945±100	−26.9			3970–3520	*3965–3625* (*89%*) or *3600–3520* (*6%*)
Ua-16973	16/94	Charcoal	Tomb 4. 3rd phase, when 2nd inner stone circle and 2 cists built (Burenhult 2001, 19)	4430±100	−26.1			3490–2880	*3360–2895*
Ua-16971	3/79	Charcoal	Tomb 4. Summary account suggests sample came from secondary cremation with barbed and tanged arrowhead (Burenhult 2001, 21)	3975±70	−25.7			2840–2280	
Ua-12736	26/94	Charcoal	Tomb 4. Summary account suggests sample was from bedding trench for stones of central cist, like Lu-1840 (Burenhult 2001, 19). Interim note describes sample as 'from the cist' (Burenhult 2000, 181)	6500±75	−26.1			5620–5310	*5615–5585* (*4%*) or *5570–5320* (*91%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	δ^{13}C (‰)	δ^{15}N (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Carrowmore 7, Co. Sligo									
Lu-1441	I:77	Charcoal	Tomb 7. Charcoal partly from posthole at centre of central chamber of monument, within undisturbed bottom layer in chamber, partly from an indeterminate context in that layer, which included charred bark near the posthole (Bergh 1995, 104). Upper fills of chamber had been disturbed in recent times. Intact cremation deposits survived in corners of chamber, between orthostats, with burnt seashells, charcoal and, in one case, fragments of an antler pin (Burenhult 1980, 19–32, figs 5, 8, photo 8). Figs 5 and 8 show the posthole as *c*. 0.25 m in diameter. Photo 8, which lacks a scale, shows the truncated base of a dark postpipe occupying approximately 1/3 of the width of the posthole, suggesting that the post was *c*. 0.10 m in diameter. Described as dating construction (Burenhult 2001, 21). Mild pretreatment with NaOH and HCl (Hakansson 1981, 399)	5250±80	−26.2			4330–3940	*4325–4285* (*2%*) or *4270–3940* (*93%*)
Ua-16978	6/77	Charcoal	Tomb 7. No hint of context in summary account (Burenhult 2001, 20–1)	4405±70	−26.5			3350–2890	*3340–3205* (*23%*) or *3195–3145* (*6%*) or *3140–2900* (*66%*)
Carrowmore 19, Co. Sligo									
Ua-12734	ID 60207	Charcoal	Tomb 19. Rescue excavation recovered damaged central chamber. This and Ua-16981 described as dating use rather than construction (Burenhult 2001, 22)	4610±90	−24.9			3640–3020	*3635–3550* (*8%*) or *3540–3085* (*87%*)
Ua-16981	ID 60206	Charcoal	Tomb 19. Rescue excavation recovered damaged central chamber. This and Ua-12734 described as dating use rather than construction (Burenhult 2001, 22)	4915±75	−26.0			3940–3530	*3945–3855* (*10%*) or *3825–3625* (*78%*) or *3590–3525* (*7%*)
Carrowmore 27, Co. Sligo									
Lu-1698	4:79	Charcoal	Tomb 27. Charcoal from lower part of stone packing between central chamber and stone circle intermediate between it and outer kerb (Bergh 1995, 104; Burenhult 1980, 50–67; 1984, 128–31). Burenhult (1980, fig. 20) shows all three samples from this context (Lu-1698, -1808, -1810) at individual findspots close to each other near the entrance to the chamber. Chamber had been disturbed in recent times but contained cremated bone, fragmentary antler pins, walrus ivory rings, a stone bead, 2 chalk balls, sherds of Carrowkeel Ware. First millennium cal BC dates were obtained from charcoal in disturbed contexts in the chamber. Pretreated with HCl and NaOH (Hakansson 1981, 400)	5040±60	−22.9			3970–3670	*3965–3700*
Lu-1808	1:79	Charcoal	From the same context as and close to the sample for Lu-1698. Mild pretreatment with NaOH and HCl (Hakansson 1981, 401)	5000±65	−23.7			3960–3640	*3950–3655*

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*
Lu-1810	3:79	Charcoal	From the same context as and close to the sample for Lu-1698. No pretreatment; small sample; diluted; 48% sample (3 1-day counts) (Hakansson 1981, 401). Listed as Lu-1818 by Burenhult (1984, 131)	4940±85	−23.4			3960–3530	*3955–3630* (*92%*) or *3570–3535* (*3%*)
Carrowmore 51, Co. Sligo									
Ua-12731	ID 60102	Charcoal	Tomb 51. Outside E corner of central chamber, embedded in reddish, burnt area of brown/yellow layer with charcoal and artefacts above sterile limestone clay and below chamber and mound. Layer seen as deliberately deposited (Burenhult 1998, 18, 19, fig. 33)	4790±65	−26.4			3700–3370	*3695–3495* (*78%*) or *3460–3375* (*17%*)
Ua-12733	ID 60167	Charcoal	Tomb 51. Base of stone E at N corner of central chamber, between outer surfaces of stones E and F	1500±60	−26.6			AD 420–640	
Ua-12732	ID 60164	Charcoal	Tomb 51. Embedded in brown/yellow layer outside N corner of central chamber (Burenhult 1998, 18, fig. 39)	4655±65	−27.6			3640–3130	*3635–3330* (*92%*) or *3215–3185* (*2%*) or *3155–3130* (*1%*)
Ua-16108	ID 60165	Charcoal	Tomb 51. Embedded in stone packing inside structure VI, pit 48 cm diam, 35 cm deep, dug into brown/yellow layer, stone packing in bottom, much charcoal (Burenhult 1998, 18, 19, figs 22, 39–41, photos 52, 54, 55)	4740±70	−25.6			3660–3360	*3645–3365*
Ua-16110	ID 60186	Charcoal	Tomb 51. On top of sterile clay layer below brown/yellow layer, outside S limestone kerb (Burenhult 1998, 18)	5255±70	−26.3			4320–3950	*4315–4295* (*1%*) or *4265–3950* (*94%*)
Ua-11581		Human. Skull fragment with cut marks	Tomb 51. Partly excavated 1996–8. Just under the grass sod outside N corner of central chamber. Among other unburnt bone fragments and a little cremated bone apparently thrown out from chamber in course of recent disturbance (Burenhult 1998, 6, 17, 18)	4625±60	−22.7			3630–3120	
Ua-16107	ID 60074	Charcoal	Tomb 51. Structure I. ?Posthole 20 cm diam, 7.5 cm deep, cut into brown/yellow layer, outside E side of chamber, containing charcoal, flint scraper, bone fragments (Burenhult 1998, 9, figs 12, 21)	2510±70	−25.4			810–400	
Ua-11580	ID 60072	Charcoal	Tomb 51. Surface of brown/yellow layer close to stone C outside S corner of central chamber, beside Ua-1159	4775±60	−28.1			3660–3370	*3655–3490 75%*) or *3465–3370* (*20%*)
Ua-16111	ID 60193	Charcoal	Tomb 51. Surface of brown/yellow layer in E trench, directly under cairn filling (Burenhult 1998, 18, fig. 39)	4815±75	−26.7			3750–3370	*3760–3740* (*1%*) or *3715–3490* (*80%*) or *3470–3370* (*14%*)
Ua-11579	ID 60071	Charcoal	Tomb 51. Surface of brown/yellow layer near stone C, outside S corner of central chamber (Burenhult 1998, 17, fig. 40)	4830±60	−26.6			3710–3380	*3760–3740* (*1%*) or *3715–3500* (*89%*) or *3430–3380* (*5%*)

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Weighted mean (BP)	Calibrated date range (cal BC) (95% confidence)	***Posterior density estimate (cal BC) (95% probability)***
Ua-11578	ID 600667	Charcoal	Tomb 51. Surface of brown/yellow layer outside chamber, near stone C (Burenhult 1998, 17, fig. 39)	4800±70	−27.2			3710–3370	*3705–3490* (*79%*) or *3465–3375* (*16%*)
Ua-16109	ID 60177	Charcoal	Tomb 51.Embedded in brown/yellow layer outside stone E of central chamber (Burenhult 1998, 18, figs 39–41)	4745±70	−26.4			3660–3360	*3650–3365*
Carrowmore 55, Co. Sligo									
Ua-13753	ID 60512	Charcoal	Tomb 55. Partly excavated 1998. Date described as relating to use, not construction (Burenhult 2001, 29)	4970±120	−25.2			4040–3520	*4000–3515*
Carrowmore 56, Co. Sligo									
Ua-10737	ID 60256	*Corylus avellana* charcoal	Tomb 56. Partly excavated 1994–5. Dates described as relating to use (Burenhult 2001, 29). A date or dates from this tomb is described as 'from stone packing outside central chamber' (Burenhult 2003, 67). It is unclear to which date(s) this refers	4620±70	−25.9			3630–3100	*3630–3575* (*6%*) or *3535–3260* (*70%*) or *3245–3100* (*19%*)
Ua-10736	ID 60251	*Corylus avellana* charcoal	Tomb 56. Partly excavated 1994-5. Dates described as relating to use (Burenhult 2001, 29). A date or dates from this tomb is described as 'from stone packing outside central chamber' (Burenhult 2003, 67). It is unclear to which date(s) this refers	4525±80	−25.2			3500–2920	*3500–3430* (*6%*) or *3380–3005* (*86%*) or *2990–2930* (*3%*)
Ua-10735	ID 60250	Pomoideae charcoal	Tomb 56. Partly excavated 1994-5. Dates described as relating to use (Burenhult 2001, 29). A date or dates from this tomb is described as 'from stone packing outside central chamber' (Burenhult 2003, 67). It is unclear to which date(s) this refers	4495±80	−26.3			3500–2910	*3370–2920*
Ua-4488	63	*Corylus avellana* charcoal	Tomb 56. Partly excavated 1994-5. Dates described as relating to use (Burenhult 2001, 29). A date or dates from this tomb is described as 'from stone packing outside central chamber' (Burenhult 2003, 67). It is unclear to which date(s) this refers	4480±75	−22.7			3490–2910	*3365–3000* (*88%*) or *2995–2925* (*7%*)
Ua-4487	35	*Corylus avellana* charcoal	Tomb 56. Partly excavated 1994-5. Dates described as relating to use (Burenhult 2001, 29). A date or dates from this tomb is described as 'from stone packing outside central chamber' (Burenhult 2003, 67). It is unclear to which date(s) this refers	4395±65	−26.7			3340–2890	*3335–3210* (*19%*) or *3190–3150* (*4%*) or *3135–2895* (*72%*)

1. Previously published as GrN-(provisional) 4415±50 BP (e.g. Eogan 1986, 226)

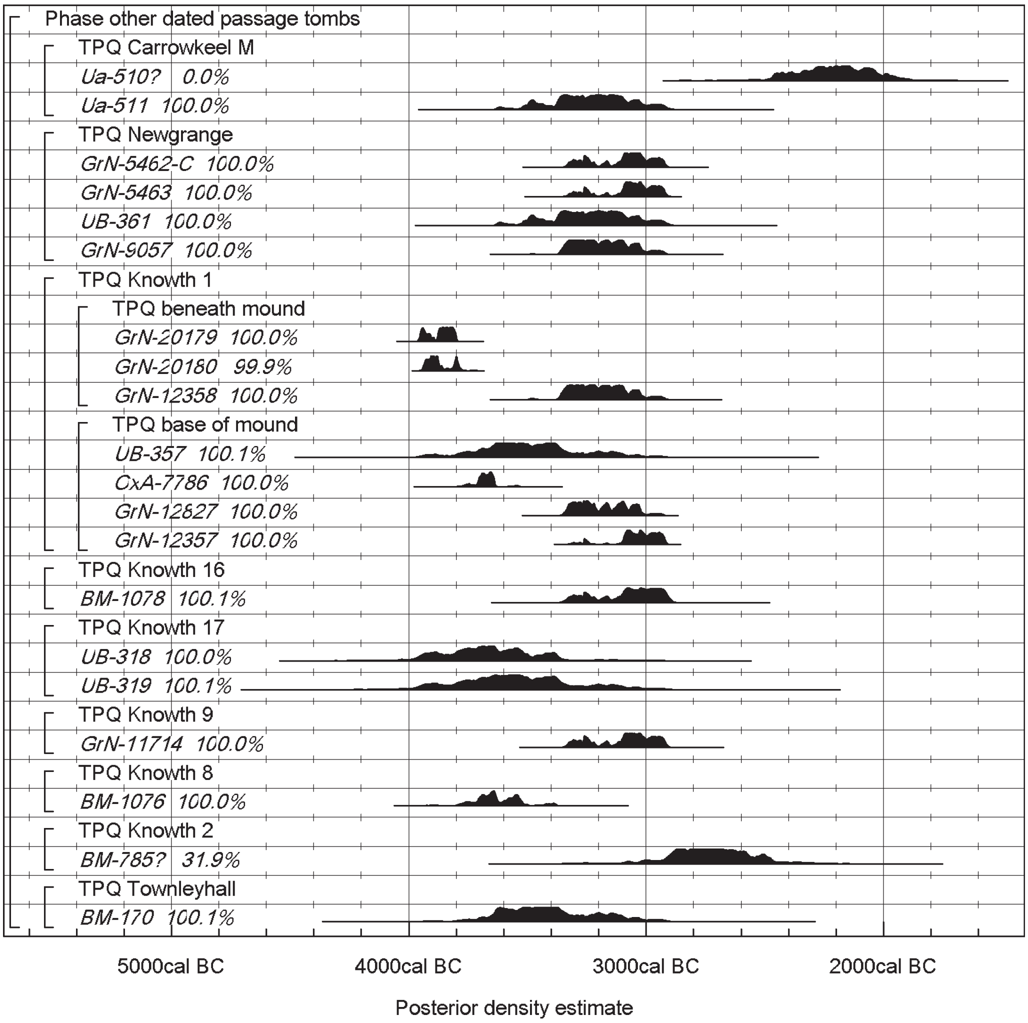

Fig. 12.46. Townleyhall, Knowth, Newgrange and Carrowkeel. Probability distributions of dates relating to passage tombs. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.45 and its other components in Figs 12.47–50.

passage tomb in Ireland currently has radiocarbon dates which unequivocally provide more than *termini post quos* for their contexts (and see further below).[15]

A bulk sample of unidentified charcoal was dated from beneath the passage tomb at Townleyhall II, Co. Louth, on the periphery of the Brú na Bóinne concentration. This measurement (Fig. 12.46: *BM-170*) thus provides a *terminus post quem* for the construction of the monument.

At Knowth, 20 smaller tombs surround the main mound, site 1. The evidence suggests that some of these 'satellites' may pre-date the enlarged, second phase of site 1, with a couple definitely post-dating it. Knowth site 16 is truncated by site 1, while the main mound appears to respect the position of sites 8 and 13. A bulk sample of unidentified charcoal (Table 12.12: BM-785) was dated from a spread within the mound of Knowth site 2, which has a cruciform chamber. At face value it should provide a *terminus post quem* for construction of the mound but, as it is close to a disturbed area with Beaker pottery, it is possible that the sample could have included some later material. Being cautious, we have therefore excluded this date from the model.

A *terminus post quem* for the construction of Knowth site 8 is provided by *BM-1076*, a bulk sample of unidentified charcoal from a pit in a sub-rectangular structure, underlying the sillstone of site 8. We have already noted this sample above (Fig. 12.46; Table 12.3). A *terminus post quem* for the end of use of Knowth site 9, with cruciform chamber, is provided by *GrN-11714*, on a sample of unidentified bulk charcoal from a cremation deposit in the end recess. Two statistically consistent radiocarbon determinations (*UB-318–9*; T'=0.2; T'(5%)=3.8; ν=1) for unidentified bulk charcoal from a thin layer under Knowth site 17, with cruciform chamber, provide *termini post quos* for its construction.

A further sample of bulk unidentified charcoal (*BM-1078*) has been dated from a spread sealed within the mound of site 16, with a simple chamber. This provides a *terminus post quem* for the construction of this mound, and also for that of site 1, which cuts this satellite. Further *termini post quos* (Table 12.3) for the construction of site 1 are provided by dates on bulk unidentified charcoal from the fill of Foundation Trench 1, under the north-east part of the main mound (*GrN-21079* and *GrN-21080*; and by a date

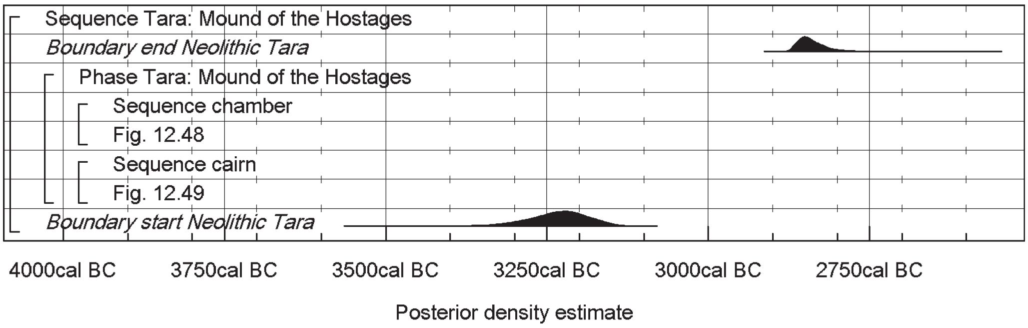

Fig. 12.47. The Mound of the Hostages, Tara. Overall structure of the component chronological model for this passage tomb. The two sub-components relating to the Mound of the Hostages are shown in Figs 12.48–9. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.45 and its other components in Figs 12.46 and 12.50.

on material from a charcoal spread on the old land surface beneath the main mound (*GrN-12358*). Five determinations are available from the material of the main mound of site 1 itself. Four (*UB-357, OxA-7786, GrN-12357, GrN-12827*) are of unidentified charcoal, and provide *termini post quos* for the construction of the main mound. A fifth determination on the humic acid fraction of the sod itself (UB-358) has not been included in the model because its result is so old that it is not relevant (Table 12.12).

Four dates provide *termini post quos* for the construction of Newgrange (Fig. 12.46; Table 12.12). *GrN-5462-C* and *GrN-5463* were measured on short-life charcoal fragments from soil caulking of the roof of the passage. Although this soil was almost certainly placed in this position when the tomb was constructed, it is unclear whether the charcoal derives from an earlier soil which has been redeposited. The samples can therefore only be treated as *termini post quos* for construction. The other two samples (*UB-361* and *GrN-9057*) are from turves forming the lower part of the mound. These again provide only *termini post quos* for construction. A date (UB-360) on the humic fraction of a turf layer, slightly higher than *UB-361*, is anomalously young and may have been affected by the penetration of younger material through the loose stone material of the mound (Table 12.12; A. Smith *et al*. 1971, 452).

Two dates (Fig. 12.46: Ua-510, *-511*) are available from Carrowkeel site M, Co. Sligo, both on short-life material from within the end recess of the chamber. Both provide *termini post quos* for the final use of the monument. Ua-510, however, appears to relate to Bronze Age re-use of the monument and so has been excluded from the present model.

Five radiocarbon dates are available from Croaghaun, Co. Sligo (Table 12.12: Ua-713, St-10452–5; Bergh 1995, 105, 225). None are modelled. The exceptionally large standard deviations (the greatest is 675 years) of measurements for samples from beneath the cairn would alone reduce their value as *termini post quos* and the fact that all three are of disparate ages (in one case extending into the historical period; T'=20.90; T'(5%)=6.0; ν=2) indicate that the cairn had been subjected to disturbance. The remaining two measurements (Ua-713, St-10453) have smaller standard deviations and are both from cremation deposits, one of them *in situ*. The samples for both were of pine charcoal, and pine does not normally live longer than two to three centuries, so that, other things being equal, one could regard both these samples as relatively close in age to the construction and use of the monument. They date, however, to the sixth and fifth millennia cal BC. It is plausible that these samples derive from bog pines, and we have therefore not included these dates in the current model.

The Mound of the Hostages, Tara, has a simple chamber and outer portal stones set within a small cairn but is distinguished by two features (M. O'Sullivan 2005). First, it has an extended sequence, which begins with pre-cairn features including pits, hearths and a segment of ditch, and extends to Early Bronze Age burials in the earthen capping over the cairn. Secondly, there are very substantial numbers of human remains, cremated and unburnt, from the compartments of the chamber, from three cists built against the backs of the chamber orthostats, and from the perimeter of the tomb. Nine dates are available on samples from beneath the tomb. There are 15 dates on human bone associated with the cists and chamber, and 11 on human bone from burials around the perimeter of the cairn; there is also one date from charcoal in the original turf covering directly over the stone cairn (Table 12.12). There are a further four dates on human bone from Early Bronze Age contexts in the chamber, 14 from Early Bronze Age cremations in the enlarged mound, and nine from Bronze Age and later activity around the tomb, but these are not considered here. This outstanding series constitutes not only the largest sample of radiocarbon measurements for an Irish passage tomb, but also one of the most complex sequences.

Nine radiocarbon dates have been obtained from material which probably pre-dates the stone cairn (Fig. 12.49). Four of these samples are from the pre-cairn ditch on the western side of the monument (M. O'Sullivan 2005, fig. 20). One consisted of unidentified bulk charcoal measured in the pioneering days of radiocarbon dating at Trinity College, Dublin (D-42). Three samples of short-life charcoal have been dated more recently (*GrA-17674*, *-17676*, *GrN-26065*). The latest of these samples may provide the best indication of the date of this feature.

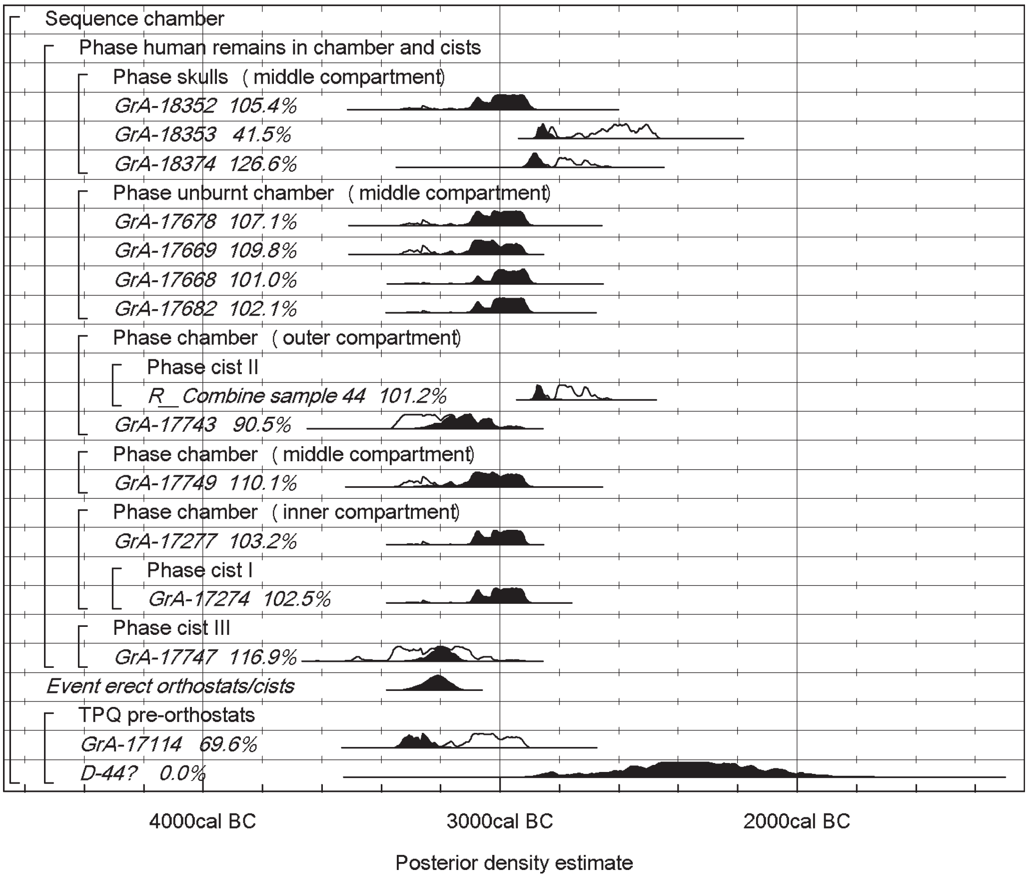

Fig. 12.48. The Mound of the Hostages, Tara. Probability distributions of dates relating to the chamber sequence. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.45 and its other components in Figs 12.46–7 and 12.49–50.

Of these samples, only *GrA-17676* came from a context which was actually sealed by the cairn; the other dates are interpreted as earlier than the stone cairn on the basis that the ditch is a single feature. Two further samples, one of unidentified bulk charcoal (D-44) and the other of oak charcoal (*GrA-17675*), also provide *termini post quos* for the construction of the cairn. D-44 probably also provides a *terminus post quem* for the erection of the portal stones (Fig. 12.48). Three further determinations are available from the old ground level under the cairn (Fig. 12.49). *GrA-17525* and *GrN-26064* seem to have comprised short-life species. D-43 was unidentified and so only provides a *terminus post quem* for its context. It is argued below that the turf covering was placed over the stone cairn very shortly after its construction. A sample of charcoal from a turf of the sod covering (*GrA-17672*) must therefore pre-date the construction of the cairn.

The process of constructing the chamber began with the excavation of a bedding trench for the orthostats. This was cut through the deposit which probably furnished the sample for D-44, and once the stones had been placed on the inner edge of the cut, the exterior part of the trench was filled with material that included cremated bone. A single fragment of cremated bone from behind the backstone has been dated from this deposit (Fig. 12.48: *GrA-17114*). Because of its inaccessible position behind a substantial orthostat, this sample cannot have been introduced from the chamber. Once the orthostats had been erected, three small stone cists were added to the exterior of the chamber (M. O'Sullivan 2005, figs 58–9). Human bone could now be deposited in both chamber and cists. One sample has been dated from the basal part of cist I (*GrA-17274*), which contained the cremated remains of at least eight adults and a range of finds including a complete miniature Carrowkeel bowl. Two statistically consistent replicate determinations (Table 12.12: GrA-17272 and -17746) were obtained from a cremated bone fragment from cist II (*sample 44*). This contained the cremated remains of at least 34 adults and a range of finds. A single determination is available from cist III (*GrA-17747*). This contained at least 13 cremated adults and numerous finds, including a large intact Carrowkeel bowl (M. O'Sullivan 2005, figs 77–8). The bulk of these deposits must have been placed in the cists before the cairn was constructed over them, but some fragments of cremated bone may have been introduced into them subsequently, since all three cists coincided with gaps between the orthostats of the chamber which were only incompletely sealed with smaller stones (M. O'Sullivan 2005, 66–68). It is, however, highly unlikely that complete Carrowkeel pots, such as the vessel from cist III, could have been so introduced. The presence of rodent-sized bones (M. O'Sullivan 2005, 69) may also suggest the possibility of

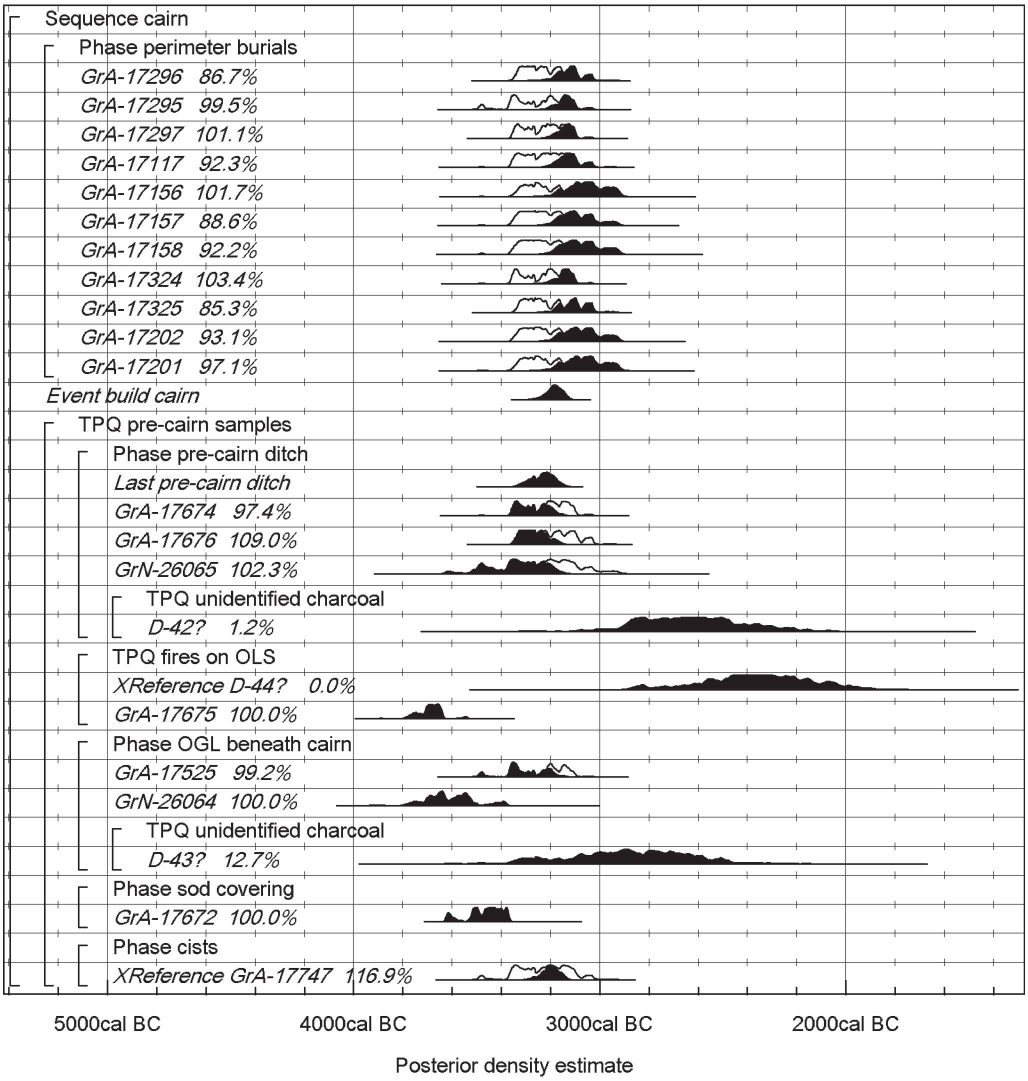

Fig. 12.49. The Mound of the Hostages, Tara. Probability distributions of dates relating to the cairn sequence. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.45 and its other components in Figs 12.46–8 and 12. 50.

later animal disturbance which could also have redeposited small fragments of material from chamber to cists. With these caveats, we have modelled the measurements from the cists as earlier than the construction of the cairn.

Ten radiocarbon determinations are available for Neolithic human remains in the chamber. Single fragments of cremated bone have been dated from the inner (Fig. 12.48: *GrA-17277*), middle (*GrA-17749*) and outer (*GrA-17743*) compartments. Probably none of these samples derive from an undisturbed deposit. Three measurements have been made on disarticulated unburnt human bone from deposit XLIX, a disturbed spread of mixed cremated and unburnt bone lying principally in the middle compartment (*GrA-17668–9*, *-17678*; M. O'Sullivan 2005, 100–3). A fourth sample (*GrA-17682*) of unburnt bone from this compartment is from a problematic context undoubtedly disturbed in the Bronze Age (deposit XXXVIII: M. O'Sullivan 2005, 96–7). Finally, three of probably 15 unburnt skulls from the middle compartment were dated (*GrA-18352–3*, *-18374*). It should be noted that although the human remains in the chamber were overwhelmingly dominated by cremated individuals (at least 73 adults), as opposed to perhaps nine inhumations and 15 unburnt skulls, the dated sample consists disproportionately of unburnt bone. This stemmed from the need to establish to what extent the unburnt human remains in the chamber were coeval with the cremated material and to what extent they were Early Bronze Age insertions.

After the human remains had been deposited in the cists, but not necessarily after all the human remains had been deposited in the chamber, a stone cairn was raised over both (M. O'Sullivan 2005, fig. 57). In the model presented here, we have placed the Neolithic cremations which follow the perimeter of the stone cairn after the construction of the cairn, since they respect it spatially. It is possible that they also post-date the earthen mound. This interpretation is supported by the fact that, unusually, the cairn had no kerb, but rather a rudimentary revetment (M. O'Sullivan 2005, fig. 127). Despite this, there does not seem to have been slippage of stones from the cairn,

suggesting that the sod layer and earth mound followed on relatively swiftly (M. O'Sullivan 2005, 163). As excavated, some of the perimeter burials (e.g. nos 2, 3, 13 and 15) lay underneath the earthen mound, although none of them were so far from its edge that they could not have been covered by later earthen slippage. Other than this, the only stratigraphic relationships recorded for the perimeter burials are between undated burial 1 and the underlying pit B which contained sherds probably of both Carinated Bowl pottery and Grooved Ware (M. O'Sullivan 2005, 31–3, 42, 55); and between undated burials 5 and 6 and firepit I, which may have cut them (M. O'Sullivan 2005, 36 and 43). Of the 17 perimeter cremations, 11 have provided radiocarbon dates (Table 12.12).

A model which incorporates the radiocarbon dates and stratigraphic sequence described above has very poor agreement ($A_{overall}$=0.0%). This is accounted for by the anomalously young ages reported by the Dublin laboratory in the late 1950s and by surprisingly recent dates for samples from cists I and II (*GrA-17274* and *sample 44*). These results have poor agreement with the interpretation that the cists pre-date the raising of the cairn, and the samples appear to have been introduced from the deposits in the chamber, through gaps between the orthostats (M. O'Sullivan 2005, figs 70–1). This interpretation has been included in the model.

The overall structure of the model for the Neolithic use of the passage tomb of the Mound of the Hostages at Tara is shown in Fig. 12.47, with the components relating to the chamber and the cairn in Figs 12.48–9 respectively. This model suggests that the chamber and cists were constructed in *3295–3140 cal BC* (*95% probability*; Fig. 12.48: *erect orthostats/cists*), probably in *3250–3170 cal BC* (*68% probability*). The cairn was constructed in *3255–3120 cal BC* (*95% probability*; Fig. 12.49: *build cairn*), probably in *3210–3145 cal BC* (*68% probability*). The main phase of Neolithic burial ended in *2875–2790 cal BC* (*95% probability*; Fig. 12.47: *end Neolithic Tara*), probably in *2865–2825 cal BC* (*68% probability*). Pre-cairn activity occurred in the mid-fourth millennium cal BC (Fig. 12.49). Only the pre-cairn ditch has sufficient measurements to enable a formal estimate of its date. This suggests that the ditch may have been infilling by *3325–3150 cal BC* (*95% probability*; Fig. 12.49: *pre-cairn ditch*), probably by *3280–3260 cal BC* (*10% probability*) or *3255–3175 cal BC* (*58% probability*).

The model for the chronology of the Neolithic use of the Mound of the Hostages presented here is just one of a range of possible interpretations of what is a complex structural sequence. One alternative, for example, would be that the perimeter deposits were made to define this special place before the cairn was built, but possibly around the same time the tomb and cists were constructed. Human remains were introduced into the tomb and cists over time, and at some later stage the cairn and mound were constructed (M. O'Sullivan 2005, 222). In support of this view, the occurrence of cremated bone in the orthostat trench and of unburnt human bone on the surface underneath the cairn suggests that the construction of the cairn did not precede the Neolithic burial phase. In this case, the perimeter burials would pre-date the cairn and mound. Further discussion will be presented elsewhere (Bayliss and O'Sullivan forthcoming; Smyth forthcoming).

At Carrowmore, 37 samples have been measured from contexts related to passage tombs, one on human bone, five on short-life charcoal and the remainder on charcoal for which identifications are not available (Burenhult 1980, 114–5; 1984, 128–32; 2001; 2003; Håkansson 1981). Most of the more recently obtained results are available only with brief, generalised contextual information (Table 12.12; Burenhult 2001; 2003). Fuller contextual information, partly due to reassessment by Stefan Bergh (1995), is available from the first phase of work at Carrowmore 4 (Table 12.12: Lu-1750, -1840); from Carrowmore 7 (Table 12.12: Lu-1441); and from Carrowmore 27 (Table 12.12: Lu-1698, -1808, -1810); as well as from more recent work at Carrowmore 51, for which a detailed interim report is available (Burenhult 1998). The plans show that the samples were from single findspots (e.g. Burenhult 1980, fig. 27). The available contextual information is summarised in Table 12.12. The model shown in Fig. 12.50 treats all the unidentified charcoal samples as *termini post quos* for their contexts and treats samples attributed to tomb use by Göran Burenhult (2001; 2003) as coming from post-construction contexts. Given the limited availability of detailed contextual information, the models for the chronology of the Carrowmore tombs presented here are of necessity highly provisional. In contrast to our interpretation of these dates as *termini post quos* for the final Neolithic use of these monuments, Alison Sheridan (e.g. 2003a; 2003b) interprets the charcoal dates from the smaller, simpler tombs as showing them to be earlier than the large, central tomb (51), starting *c.* 4000 cal BC and echoing the forms of early Breton monuments. It is worth noting, however, that where finds have been recovered (such as from Carrowmore 4, 7 and 27), they are of very similar style to those in other Irish passage tombs, including Carrowkeel pottery and antler pins. It has been argued (e.g. Sheridan 2003a) that these represent re-use of sites during the development of the cemetery and the passage tomb tradition over the fourth millennium cal BC. However, given the number of passage tombs that have been excavated, the lack of demonstrably early Neolithic material in any of them makes it difficult to sustain the argument that all the middle Neolithic cultural material in them was inserted following the clearing out of earlier deposits. The antler pins are currently the subject of an AMS dating programme by Robert Hensey of the National University of Ireland, Galway.

In Carrowmore 4, there was more than one constructional phase, of which there are several possible interpretations. A central passage and chamber (known as the central cist) were surrounded and possibly blocked by two concentric circular stone settings, the outer of which incorporated two small cists (A and B). These features were covered by a cairn with a substantial kerb. One measurement (Fig. 12.50:

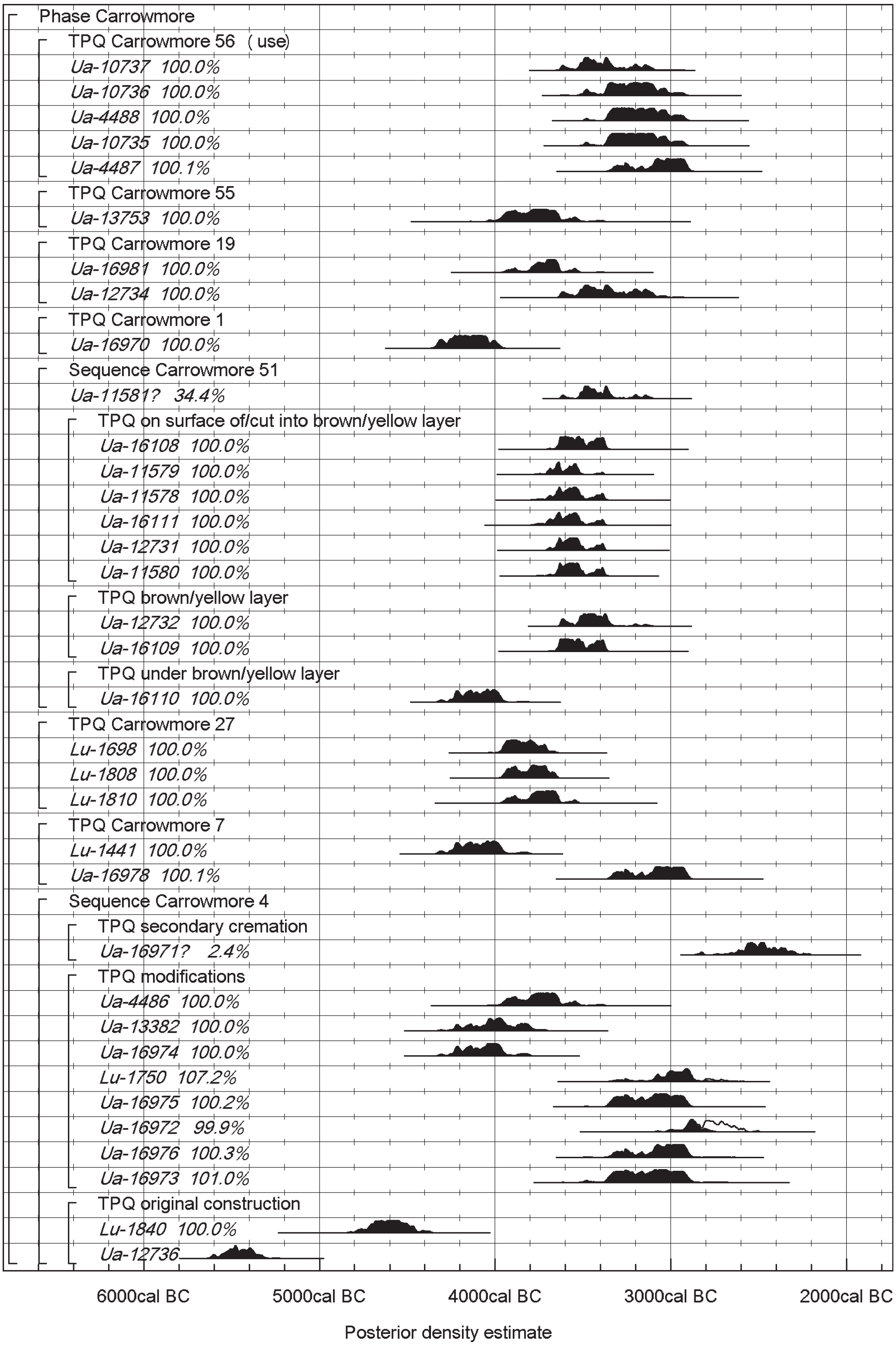

Fig. 12.50. Carrowmore. Probability distributions of dates from passage tombs. The format is identical to that of Fig. 12.6. The overall structure of this model is shown in Fig. 12.45 and its other components in Figs 12.46–9.

Lu-1840) provides a *terminus post quem* for the chamber; a second (Fig. 12.50: *Ua-12736*) may do the same. Of the remainder, *Lu-1750* provides a *terminus post quem* for the piling of a second, larger mass of stone packing around the chamber, and *Ua-4486*, *-13382*, and *-16972–6* all seem to be *termini post quos* for this or other modifications to the monument (Fig. 12.50). *Ua-4486* consisted of short-life charcoal, although the taphonomy of this sample is not clear. Ua-16971 provides a *terminus post quem* for a secondary cremation but is excluded from the model as it does not appear to relate to the main Neolithic use of the tomb.

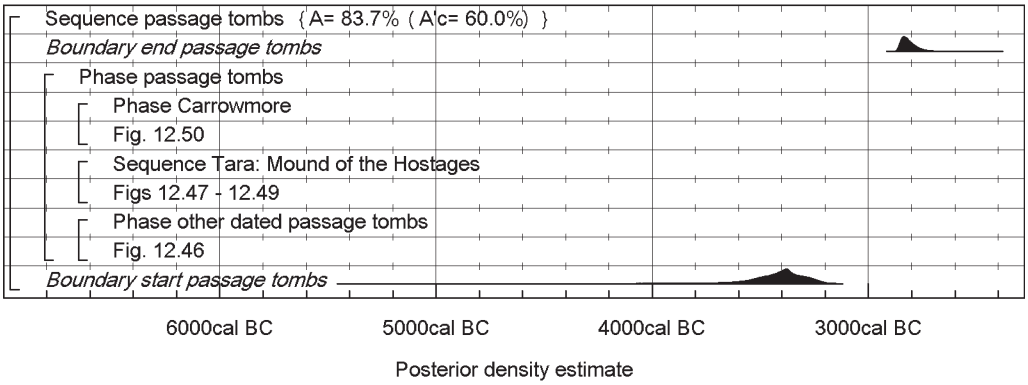

Fig. 12.51. Passage tombs. Overall structure of the alternative chronological model. The structures of the component sections of this model are shown in detail in Figs 12.46–50, with the modifications described in the text (although the posterior density estimates shown on these figures are not those relating to this model). The format is identical to that of Fig. 12.6. The large square brackets down the left-hand side of Figs 12.51 and 12.46–50 (with the modifications described in the text), along with the OxCal keywords, define the overall model exactly.

In Carrowmore 7, a bulk sample (Fig. 12.50; Table 12.12: *Lu-1441*) came from more than one context (Bergh 1995, 104), some of it from a posthole at the centre of the chamber from which the chamber was thought to have been laid out (Burenhult 1980, 21, photo 8, figs 5–8). The feature's relation to the chamber is questioned by Caulfield (1983, 207–8), on the grounds that it was sealed by a layer covering the chamber floor, at a level where no cremations were found, and may have been contemporary with postholes and concentrations of shells below and extending beyond the tomb. In either case, it provides a *terminus post quem* for the deposition of the 'culture layer' on the chamber floor. The context of a more recently measured sample of charcoal from the tomb (Fig. 12.50; Table 12.12: *Ua-16978*) remains unknown. In these circumstances, this only provides a *terminus post quem* for the end of use of the monument.

In Carrowmore 27 (Fig. 12.50), charcoal samples from three adjacent findspots, in the lower part of the stone packing between the central chamber and the stone circle intermediate between it and the outer kerb (Burenhult 1980, fig. 20) provide *termini post quos* for the construction of this part of the structure (Fig. 12.50: *Lu-1698, Lu-1808, Lu-1810*).

Carrowmore 51 (Listoghil), by far the largest of the passage tombs in the complex, was excavated in 1996–8 (Burenhult 1998). Before the tomb was built, a brown-yellow layer of morainic material appears to have been spread across the site. Within it were burnt areas and artefacts. One sample (Fig. 12.50: *Ua-16110*) lay beneath this layer, and provides a *terminus post quem* for its deposition. Seven samples came from within this layer (*Ua-12732* and *-16109*) or from its surface (*Ua-11580*, *-16111*, *-11579*, *-11578* and *-12731*, the last forming part of a burnt area). Charcoal from a stone-packed pit, structure VI, cut into this layer immediately outside the chamber, is dated by *Ua-16108*. All these samples probably provide *termini post quos* for construction. Caution, however, is in order, since a posthole also close to the chamber and cut into the same layer is dated by Ua-16107, again on unidentified charcoal, to the first millennium cal BC (Table 12.12). An unstratified human skull fragment with cutmarks found under the modern turf close to the chamber is dated by Ua-11581 to 3630–3120 cal BC (95% confidence); we have not included this in the model, because of the uncertainty over its derivation. A further charcoal sample from the stone cairn, just outside the north corner of the central chamber, is dated to the first millennium AD by Ua-12733 (Table 12.12). There was obviously disturbance in the area around the chamber, further evidenced by artefacts of later type (Burenhult 1998, 6–8).

In Carrowmore 1, a single charcoal sample provides a *terminus post quem* for one stage or another of construction (Fig. 12.50: *Ua-16970*). Two measurements (Fig. 12.50: *Ua-16981*, *-12734*) from unidentified charcoal samples described as dating the use of Carrowmore 19 (Burenhult 2001, 22) provide *termini post quos* for the end of its use. A similar sample (*Ua-13753*) provides a *terminus post quem* for the final use of Carrowmore 55.

Five radiocarbon dates are available on short-life charcoal from Carrowmore 56 (Fig. 12.50: Table 12.12: *Ua-10735–7, -4487–8*). Again, these are described only as deriving from the use of the tomb (Burenhult 2001, 29) and so at this stage of analysis can only be interpreted as providing *termini post quos* for the final use of the monument. It should be noted, however, that these measurements are statistically consistent (T'=5.7; $T'(5\%)$=9.5; ν=4) and so in fact they may provide accurate dates for the use of this monument.

The model for the date of the construction and primary Neolithic use of passage tombs in Ireland is shown in Figs 12.45–50. The form of this model is discussed above. It suggests that passage tombs in Ireland were first constructed in *5275–3160 cal BC* (*95% probability*; Fig. 12.45: *start passage tombs*), probably in *4005–3190 cal BC* (*68% probability*)! The first use of passage tombs ended in *2870–2715 cal BC* (*95% probability*; Fig. 12.45: *end passage tombs*), probably in *2855–2785 cal BC* (*68% probability*). This estimate for the time when the primary

Neolithic use of passage tombs ceased may be reasonably reliable, since it depends not only on the dated burials from Tara, but also on a large number of *termini post quos* from a range of other sites. Our estimate for the time when passage tombs were first constructed in Ireland, however, is obviously unsatisfactory as the Mound of the Hostages at Tara is the only site which has dates that are definitely not *termini post quos*. The existing *termini post quos* for tomb construction, however, seem more compatible with a currency for the passage tombs of Ireland falling in the second half of the fourth millennium cal BC (Figs 12.46 and 12.50). It is to be hoped that further research on surviving archives will enhance this dataset in the near future.[16]

Nonetheless, in an attempt to explore how limited our understanding of the chronology of Irish passage tombs is, given the data currently available, we have constructed a second model. In this we have adopted the most charitable interpretations of the taphonomy of the dated samples. In this alternative model, the following samples have been rehabilitated and are included as dating the use of the relevant tomb rather than as *termini post quos* for final use. GrN-5462-C and GrN-5463 from Newgrange are interpreted as deriving from activity contemporary with the construction of the tomb; Ua-11581 from Carrowmore 51 is interpreted as deriving from the use of the chamber (Burenhult 1998, 6, 17–19); and Ua-10735–7 and Ua-4487–8 from Carrowmore 56 are interpreted as relating to the use of the monument. The overall form of this alternative model is that shown in Fig. 12.51.

In this second model, we estimate that passage tombs began to be constructed in *3640–3205 cal BC* (*95% probability*; Fig. 12.51: *start passage tombs*), probably in *3495–3285 cal BC* (*68% probability*). Their first use ended in *2870–2735 cal BC* (*95% probability*; Fig. 12.51: *end passage tombs*), probably in *2860–2795 cal BC* (*68% probability*). This analysis demonstrates the limitations of our current understanding of the chronology of passage tombs in Ireland. Further samples of short-life material unequivocally associated with the primary use of these monuments are urgently required. Our estimates for when passage tombs were first built are extremely tentative at this stage, although a date within the third quarter of the fourth millennium cal BC is most plausible at present. In contrast, our estimates for when the initial use of these tombs ended are more robust. Both models suggest that this ending fell in the second half of the 29th century cal BC or a decade or two later.

Other fourth millennium cal BC activity

Further radiocarbon dates which fall in the fourth millennium cal BC have been obtained on archaeological material from Ireland. These are not, however, associated with diagnostically Neolithic material. They are therefore not included in the models for the chronology of the early Neolithic in Ireland presented below, although they undoubtedly reflect other aspects of contemporary life and are discussed here for completeness.

One of two burials from Kilgreany Cave, Co. Waterford, dated by *Pta-2644*, already noted above, lay some 7 m away from plain Carinated Bowl sherds, to which it may relate, although this is not demonstrable (Dowd 2002, 82, fig. 2b). The second, stratified above the first and dated by *BM-135* (Table 12.13), was tightly flexed, but not associated with any diagnostic cultural material (Fig. 12.52). Two further burials at the same sort of level were close to a stone axehead fragment, but also not directly associated with diagnostic material. A third individual from the cave has also been dated (GrA-21499; Table 12.13). The Kilgreany burials form part of a tradition of burial and deposition of human bone in caves in Neolithic Ireland which shows overlap in practice and material with other funerary traditions. A series of dates for other articulated burials and disarticulated human bone from caves span the fourth millennium cal BC, concentrated in the second and third quarters (Fig 12.52, and see note 11; Dowd 2008). The $\delta^{13}C$ values from these burials suggest that the dated individuals consumed a diet largely based on terrestrial resources, although it is debatable whether such signatures imply that the individuals concerned can be meaningfully classed as Neolithic (see Chapter 11.4). A crouched but unassociated inhumation was found in the south part of the midden at Dalkey Island, Co. Dublin (already discussed above) and dated by BM-78 (recalculated) to the end of the fourth millennium cal BC (Fig. 12.52; Brindley and Lanting 1990).

Fragments of a waterlogged oak logboat were dredged from the River Bann at Ballynagowan, Co. Armagh, in 1993 (Fry 2000, 106). The largest fragment, a 1.57m length of a floor rising to one of the original ends was dated by GrN-20550 (Fig. 12.52) to the fourth millennium cal BC (Lanting and Brindley 1996, 86). Further logboats with fourth-millennium dates have been dated from Rossfad, Co. Fermanagh, Ballylig, Co. Antrim, and Strangford Lough, Co. Down (Table 12.13; Fig. 12.52; O'Sullivan and Breen 2007, 74–8). Logboats are not, however, diagnostic of Neolithic material culture as Mesolithic examples are known from Europe (Lanting and Brindley 1996, 92, with references), including an example from Brookend, Co. Tyrone which has been dated to 5490–5350 cal BC (UB-4066; 6457±35BP; Fry 2000, 116; O'Sullivan and Breen 2007, 54–5).

At Cloghaclocka, Co. Limerick, one of three birch planks, thought to form the base of a trough in a damaged *fulacht fiadh*, was dated by GrN-15404 to the fourth millennium cal BC (Fig. 12.52; Table 12.13). This has been considered a surprisingly early date for a burnt mound (Brindley *et al*. 1990, 27); perhaps this is re-used bog birch.

12.4 Discussion

Dating the introduction of the Neolithic into Ireland

A wide range of forms of early Neolithic activity in Ireland that have scientific dates have now been discussed, along with dates from Linkardstown burials and passage tombs,

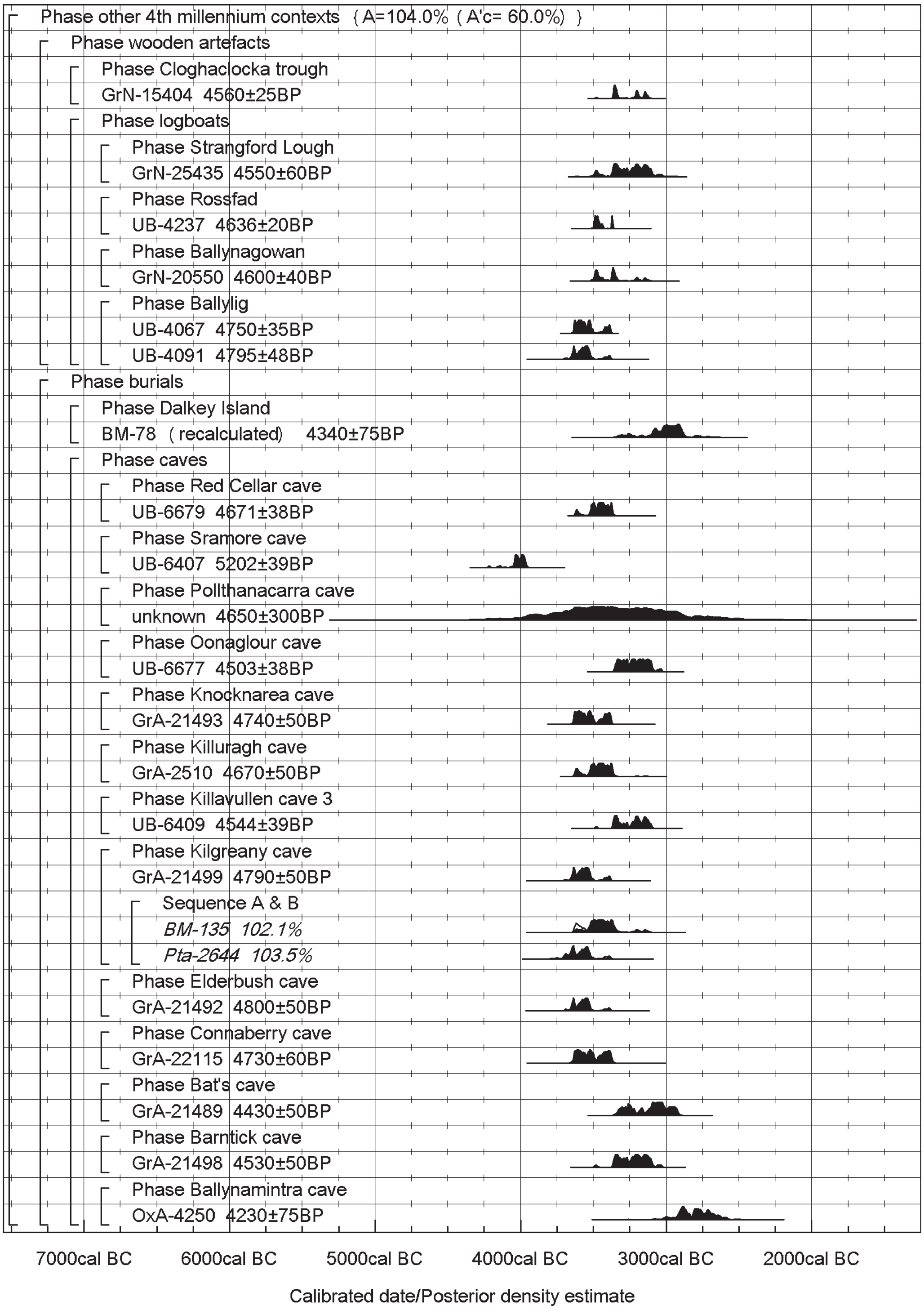

Fig. 12.52. Fourth millennium cal BC dates for contexts without diagnostic artefacts. Probability distributions of dates. Dates with laboratory numbers in normal type have been calibrated only (Stuiver and Reimer 1993).

the dated sample of which it is argued provides *termini ante quos* for the end of the early Neolithic period. It is now time to combine these elements into different models which estimate the date when the Neolithic came to Ireland. The purpose of these models is to put the Donegore and Magheraboy enclosures into context, and so the dates from those sites are not included in the models.

The first decision concerns which forms of activity to include in the early Neolithic period. The rectangular timber houses and other occupation associated with early Carinated Bowl pottery are certainly to be included. It has also often been suggested that portal tombs, court tombs, and other related monuments should fall in this period (Cooney 2000a), as might the Céide Fields and fields on Valencia Island (Caulfield 1978; 1983; Cooney 2000a). This range could be characterised as representing much of the character of a Carinated Bowl Neolithic tradition in Ireland (Cooney 2007a; Sheridan 2007a). Other forms of

Table 12.13. Radiocarbon dates for other fourth millennium cal BC activity in Ireland.

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)
Castlefarm, Co. Kildare						
OxA-7955		*Fraxinus* charcoal	F2. Bowl-shaped pit measuring 0.60 m x 0.40 m x 0.20 m deep. One of 15 charcoal-rich features within, cutting, and outside three concentric ditches, the outermost of which enclosed an area with an estimated diameter of 100 m. Little is known of any of these features because excavation was restricted to areas that would be destroyed by development. F2 was the only charcoal-rich features excavated and it is unclear whether it was one of those which cut the ditches. Small fragments of burnt bone were observed in the surfaces of other charcoal-rich features	5040±45		3970–3700
Newtown, Co. Meath						
UB-3568		Charcoal (unidentified)	Pit (Monk 2000, 76) uncertain if the same pit as source of UB-3569	4996±39	−26.2	3950–3660
UB-3569		Charcoal (unidentified)	Pit (Monk 2000, 76) uncertain if the same pit as source of UB-3568	5059±31	−26.4	3960–3770
Gortaroe, Co. Mayo						
GrN-27801	II 165-26	*Quercus* charcoal	External pit (C26) in scatter 10 m SE of house (Richard Gillespie pers. comm.)	4865±35	−25.2	
GrN-27798	II 1-2	*Corylus* charcoal	External pit with stone lining (C2), NE of house (Richard Gillespie pers. comm.)	4040±30	−26.5	2840–2470
Ballygalley, Co. Antrim, discrete features						
UB-3210		Charcoal (unidentified)	Site 1, tr D1, sq 12, hearth-pit 1002/2	5151±119		4310–3660
UB-3326		Charcoal (unidentified)	Site 1, main trench, sq K5, pit 1990	5046±101	−26.1	4050–3640
UB-3363		Charcoal (unidentified)	Site 1, main trench, sq K-M 6-7, pit 1026	5469±69	−26.3	4460–4170
UB-3374		Charcoal (unidentified)	Site 1, main trench, sq J9-10, pit 1030	5002±92	−26.4	3980–3630
UB-4818		Charcoal (unidentified)	Site 1, tr U, sq U17-18, pit 1107	4929±50	−26.3	3900–3630
UB-4839		Charcoal (unidentified)	Site 1, sq H-J 7-9, pit 1052	4493±60	−26.3	3370–2920
UB-4840		Charcoal (unidentified)	Site 1, sq AV-AT, 10- , cobbles 1164/1	4631±44	−27.0	3620–3340
UB-3368		Charcoal (unidentified)	Site 2, tr X, sq 13-14, pit 2002	4821±67	−26.8	3710–3370
UB-3925		Charcoal (unidentified)	Site 2, sq A3, deposit 202	5082±91	−26.3	4050–3650
UB-3926		*Pinus sylvestris* charcoal	Site 2 tr W sq 13-14, pit 2020/2	4881±62	−25.8	3970–3520
UB-4812		Charcoal (unidentified)	Site 2, tr W1, sq 4-5, 9-10, pit 2043	4563±41	−26.8	3500–3100
UB-4813		Charcoal (unidentified)	Site 2, sq K8, pit 2339	4690±42	−26.4	3640–3360
UB-4816		Charcoal (unidentified)	Site 2, sq L15–16, slot 2501	4876±56	−26.4	3780–3530
UB-4819		Charcoal (unidentified)	Site 2, sq M11–12, pit 2309	4684±58	−26.2	3650–3350
UB-4821		Charcoal (unidentified)	Site 2, tr S, sq P7–8, pit 2035	4575±59	−26.7	3520–3090
UB-4841		Charcoal (unidentified)	Site 2, tr T, sqs 2–5, pit 2044	4756±47	−26.1	3650–3370
UB-4843		Charcoal (unidentified)	Site 2, sq L9, pit 2347	4698±42	−25.3	3640–3360
Ballynagilly, Co. Tyrone, discrete features						
UB-304	L68.1, 68.2, 68.3	Charcoal (unidentified)	F (L) 211 layer 5b. Basal layer of large pit, 20 m E of house, without contents but sealed by layer containing Neolithic artefacts (A. Smith *et al.* 1971)	5370±85		4360–3980
UB-559	L67.14	Charcoal (unidentified)	F135a. Hearth overlying pit F135 (Arthur ApSimon pers. comm.)	5500±85	−23.2	4500–4170
UB-307	BG69 M3836; F46 51 54 53 + 67 16	Charcoal (unidentified)	Pit F (M) 46. In base of gully overlain by sterile sand and overlain by Beaker occupation material (A. Smith *et al.* 1971)	5640±90		4710–4330
UB-551	BG68 Ch3 + BG67 Ch25	Charcoal (unidentified)	F (M) 67. 'Cooking pit' (Arthur ApSimon pers. comm.)	5290±50	−25.3	4320–3970
Cloghaclocka, Co. Limerick						
GrN-15404	2/40/1	*Betula,* part of 1 of 3 waterlogged planks	Lying parallel to each other in damaged *fulacht fiadh*, probably base of trough (Gowen 1988, 133). Brindley *et al.* consider C_v value of 65.5% too high for wood though suggestive of charcoal and suspect that samples may have been confused (1990, 27)	4560±25	−27.3	3370–3120

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)
Ballynagowan, Co. Armagh						
GrN-20550		*Quercus* sp. wood from waterlogged logboat	Dredged from river Bann 1993 (Lanting and Brindley 1996; Fry 2000, 50)	4600±40	−24.1	3500–3130
Rossfad, Co. Fermanagh						
UB-4237		Unidentified waterlogged wood from incomplete logboat	Observed 1972 but remaining *in situ*, at least 8.65 m long with a beam 0.65-0.75 m wide (Fry 2000, 50)	4636±20	−25.8	3500–3360
Strangford Lough, Co. Down						
GrN-25435		Unidentified waterlogged wood from logboat	Substantially complete logboat recovered from the foreshore at Greyabbey Bay (McErlean *et al*. 2002, 404–6; Forsythe and Gregory 2007)	4550±60	−26.6	3500–3020
Ballylig, Co. Antrim						
UB-4607		*Quercus* sp. wood from waterlogged logboat	Largely complete oak logboat, 5.4 m long, 0.65 m wide, and 0.2 m high, which emerged from a layer of peat underlying marine mud on the edge of Larne Lough in 1996 (Fry 2000, 117)	4750±35	−24.2	3640–3370
UB-4091		*Quercus* sp. wood from waterlogged logboat	Fragmentary oak logboat which emerged from a layer of peat underlying marine mud on the edge of Larne Lough in 1996 (Fry 2000, 118)	4795±48	−24.1	3660–3380
Dalkey Island, Co. Dublin						
BM-78 (recalculated)	Burial 2	Human. Bone	Unprotected crouched inhumation in south midden (D. Liversage 1968, 103–4). Recalculated and corrected by Brindley and Lanting (1990)	4340±75		3330–2870
Ballynamintra Cave, Co. Waterford						
OxA-4250	Sample 61	Human. radius	Cave containing Pleistocene and later fauna and a few human bones (Woodman *et al.* 1997)	4230±75	−22.5	3020–2580
Barntick Cave, Co. Clare						
GrA-21498		Human. Adult male mandible	The Barntick, Bats' and Elderbush Caves formed part of a single complex, investigated 1902–4. Deposits seem to have been mixed, incorporating both early Holocene and recent fauna, artefacts ranging from prehistoric to medieval in date, and numerous disarticulated human bones (Scharff *et al.* 1906; Woodman *et al.* 1997; Dowd 2008)	4530±50	−21.6	3490–3020
Bats' Cave, Newhall, Co. Clare						
Gr-21489		Human. Scapula of child <10 yr	As GrA- 21498	4430±50	−21.8	3350–2910
Connaberry Cave, Co. Cork						
GrA-22115		Human. Adult R maxilla	Small chambered cavern with a thin floor deposit containing recent fauna, some human bone fragments and a 16th century coin (Gwynn *et al.* 1942, 371; Coleman 1947, 72; Dowd 2008)	4730±60	−22.1	3650–3360
Elderbush Cave, Newhall, Co. Clare						
GrA-21492		Human. Adult pelvis	As GrA- 21498	4800±50	−21.3	3660–3380
Kilgreany Cave, Co. Waterford						
BM-135	Kilgreany A	Human. Humerus and ribs of middle-aged woman. Standard acid pretreatment	Placed tightly flexed on charcoal-rich deposit (C7) with large stone slab on L shoulder. Two further relatively intact burials at same horizon, close to stone axehead fragment. Stratified above Pta-2644 and separated from it by stalagmite (Dowd 2002, 83; Molleson 1986; Barker and Mackey 1968)	4660±75		3640–3120
Pta-2644	Kilgreany B	Human. R femur from adult male	Placed on charcoal-rich deposit (C9), with large number of stones over skull and upper thorax. Stratified below BM-135 and separated from it by stalagmite (Dowd 2002, 82; Molleson 1986)	4820±60		3710–3380

Laboratory number	Sample reference	Material	Context	Radiocarbon age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)
GrA-21499	Kilgreany 3+	Human. Adult ?male mandible	Publication does not specify context (Dowd 2008)	4790±50	−21.8	3660–3370
Killavullen Cave 3, Ballymacmoy, Co. Cork						
UB-6409		Human. Adult ?female R ilium	One of a group of caves excavated in 1934. No published report (Coleman 1947, 72; Dowd 2008)	4544±39	−22.7*	3490–3090
Killuragh Cave, Co. Limerick						
GrA-2510		Human. Metacarpal	Cave containing Late Glacial and recent fauna, Mesolithic and Neolithic artefacts, Mesolithic and Neolithic human remains (Woodman 1997; Dowd 2008)	4670±50	−22.4	3640–3350
Knocknarea Cave, Co. Sligo						
GrA-21493		Human. Occipital	Bone from floor of unexcavated cave (Dowd 2008, 307)	4740±50	−22.1	3650–3370
Oonaglour Cave, Bridgequarter, Co. Waterford						
UB-6677		Human. Adult L radius	Cave containing prehistoric and medieval artefacts (Dowd 2008)	4503±38	−21.0*	3370–3020
Pollthanacarra Cave, Legg, Co. Fermanagh						
Unknown		Human. Otherwise unknown	Swallowhole containing human remains with those of cattle, caprines, pigs, canids, red deer and hare (Dowd 2008)	4650±300		4050–2570
Red Cellar Cave, Knockfennel, Co. Limerick						
UB-6679		Human. Adult, R talus	Small fissure above Lough Gur, containing Late Glacial fauna (Woodman *et al.* 1997; Dowd 2008)	4671±38	−21.9*	3630–3360
Sramore Cave, Co. Leitrim						
UB-6407		Human. Adult ?male R femur	Bone from floor of unexcavated cave (Dowd 2008, 307)	5202±39	−20.1*	4150–3950

* $\delta^{13}C$ value measured by AMS at the Oxford Radiocarbon Accelerator Unit.

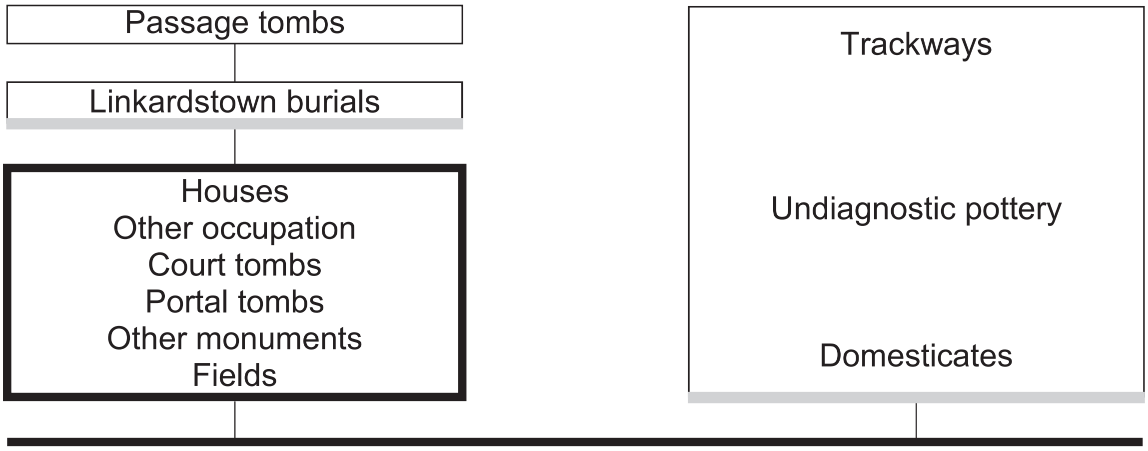

*Fig. 12.53. Model 1 of the early and middle Neolithic in Ireland. Outline of the overall model. The components of this model are the rectangular houses (Figs 12.22–7), other occupation (Fig. 12.30), portal tombs (Poulnabrone)(Fig. 12.31), court tombs (Figs 12.32–4), other monuments (Fig. 12.35), Linkardstown burials (Fig. 12.44) and passage tombs (Figs 12.45–50) – all without their surrounding uniform distributions. The trackway, undiagnostic pottery, and domesticate components are as shown in Figs 12.41–2. Three distributions for fields have been included from the models shown in Fig. 12.37 (*start clearance *and* start regeneration*) and Fig. 12.40 (*I-14206*). The heavy black line denotes the boundary 'start Neolithic', the heavy black box a uniform phase, and the grey lines* termini ante quos*.*

activity can be argued to be early Neolithic, but continue after the end of the period. These include trackways, activity associated with 'undiagnostic' forms of pottery, and plants and animals that were introduced into the island, notably cereals, cattle and sheep.

The second decision is technical. As already emphasised many times in this volume, in order to counteract the statistical scatter on a group of radiocarbon dates it is necessary to impose a distribution on the archaeological period under consideration. We have chosen to use a uniform distribution as this has been shown, both theoretically and empirically, to be 'uninformative' (Buck *et al*. 1992; Bayliss *et al*. 2007a). This means that the results of a model are relatively insensitive to a violation of this assumption.

The structure of the first model (model 1) is shown in Fig. 12.53. We have used a uniform distribution for the early Neolithic period in Ireland, shown as a box within the thick black line. Dates from trackways, 'undiagnostic' pottery and domesticates are used as *termini ante quos* for the start of the Irish Neolithic, and the sequence of Linkardstown and passage tombs has been used as a *terminus ante quem* for the end of the early Neolithic period in Ireland: indicated by the thick grey lines on the right and upper-left respectively of Fig. 12.53. The components of this model are rectangular houses (Figs 12.22–7), other occupation (Fig. 12.30), portal tombs (Poulnabrone) (Fig. 12.31), court tombs (Figs 12.32–4), other monuments (Fig. 12.35), Linkardstown burials (Fig. 12.44) and passage tombs (Figs 12.45–50) – all without their surrounding uniform distributions. The trackway, 'undiagnostic' pottery and domesticate components are as shown in Figs 12.41–2. Three distributions have been included here from the model shown in Fig. 12.37 (*start clearance* and *start regeneration*) and Fig. 12.40 (*I-14206*).

All versions of this model have extremely poor agreement ($A_{overall}$<0.5%): that is, versions which include or exclude dates on domesticates as diagnostically Neolithic activity, and models where Linkardstown burials and passage tombs are seen as sequential or overlapping periods of activity (see below). Examination of the indices of agreement for individual measurements included in this model suggests that this poor agreement arises because Parknabinnia and Primrose Grange continued in use until the middle Neolithic (as reflected in the artefacts from them). The fields may also have done so. The early measurement on cattle bone from Ferriter's Cove (OxA-3869) also has extremely poor individual agreement (A=0.6%). No graph is published for this model.

For this reason, a second model has been built (model 2). In this, houses and other occupation associated with Bowl pottery define the early Neolithic and form a uniformly distributed phase, shown as a box within the thick black line in Fig. 12.54. Portal tombs, court tombs and other related monuments, along with field systems, trackways, 'undiagnostic' pottery and domesticates provide *termini ante quos* for the start of the Irish Neolithic: indicated by the thick grey line on the lower right of Fig. 12.54. The sequence of Linkardstown burials and passage tombs again provides a *terminus ante quem* for the end of the early Neolithic: indicated by the thick grey line on the left of Fig. 12.54. The components of this model remain unaltered.

Model 2 also has poor overall agreement ($A_{overall}$=57.1% in the variant where Linkardstown burials and passage tombs are successive, and $A_{overall}$=56.6% when these traditions overlap). Examination of the indices of agreement suggests that this poor agreement arises almost entirely from the early date on a cattle bone from Ferriter's Cove (*OxA-3869*; A=0.5%). If this measurement is excluded from the model, the overall agreement goes up to 66.7% and

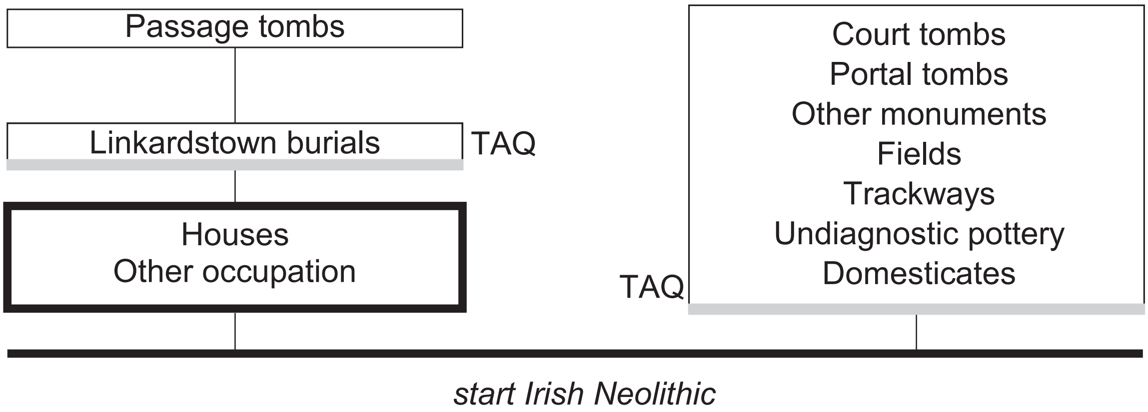

Fig. 12.54. Model 2 of the early and middle Neolithic in Ireland. Outline of an alternative overall model. The components of this model and the conventions used in the diagram are as Fig. 12.53.

66.2% respectively. However, we have seen above (Fig. 12.43) that OxA-3869 is compatible with the other dates from Ferriter's Cove. It seems special pleading, therefore, to exclude this measurement as inaccurate (although further dates from domestic fauna from Ferriter's Cove would be highly welcome). On this basis, we see no reason to accept domesticates *on their own*, without other diagnostic associations, as a sufficiently defining characteristic of the Neolithic (cf. Woodman *et al*. 1999, 144–51), and we therefore need to consider another variant of model 2, in which the dates on domestic fauna shown in Fig. 12.42 are not included in the analysis. These variants of model 2 without the domesticates and with Linkardstown burials and passage tombs as successive or overlapping phases have good overall agreement ($A_{overall}$=85.2% and 84.7% respectively). The estimates for the start of the Neolithic in Ireland for the three variants of model 2 (Fig. 12.54) where Linkardstown burials and passage tombs are successive are shown in Fig. 12.55: including (a) all the dates, (b) all the dates except for OxA-3869 from Ferriter's Cove, and (c) all the dates except those from domestic fauna. It is apparent that the results of the model are highly sensitive to the inclusion or exclusion of OxA-3869. In contrast, if this measurement is omitted, the inclusion or exclusion of the dates on other domestic fauna makes no appreciable difference. The early date from Ferriter's Cove is so radically different that either this single measurement must be appreciably inaccurate or the dated bone does not relate to wider processes of Neolithisation. Woodman and McCarthy (2003, 33) suggest that it may represent a situation where the cattle were little more than a food supplement to communities relying on marine resources but that eventually they may have had social consequences.

So, progress has been made in constructing a plausible chronological model for the introduction of the Neolithic to Ireland. Examination of the indices of agreement in alternative models has suggested that the use of court tombs, portal tombs, other related monuments and field systems continued into the middle Neolithic period, and cannot be seen as exclusively early Neolithic. This evidence also suggests that the early date on cattle from Ferriter's Cove (OxA-3869) is an extreme outlier, casting doubt on whether domesticates on their own may define the start of Neolithic practices in Ireland rather than contact with outside Neolithic communities. In contrast, all the models, whatever their other shortcomings, are in good agreement with a sequence that constrains Linkardstown burials to be later than houses and other occupation associated with diagnostic early Neolithic material, and Linkardstown burials to be earlier than passage tombs. Mathematically, this prior belief is highly informative, and so this good agreement renders the sequence inferred from associated material culture the more plausible. For these reasons, in the discussion from now on, the sequence between the end of the early Neolithic, Linkardstown burials and passage tombs remains constant. The dates on domesticates shown in Fig. 12.42 are also not included.

The form of the third model (model 3) is shown in Fig. 12.56. In this reading, houses and other occupation associated with diagnostic early Neolithic material are constrained to be earlier than Linkardstown burials and passage tombs, but all of these elements, along with court tombs, portal tombs, other related monuments, field systems, trackways and 'undiagnostic' pottery, form one uniformly distributed phase of activity which spans the early and middle Neolithic of Ireland. This is indicated on Fig. 12.56 by the box with a thick black line around it. This model has good overall agreement ($A_{overall}$=88.0%), so this interpretation of the data is plausible.

The estimates for when the Irish Neolithic began, derived from the variants of models 2 and 3 which do not include dates on domestic fauna, are shown in Fig. 12.57. According to model 2, Neolithic things and practices began in Ireland in *3750–3680 cal BC* (*95% probability*; Fig. 12.57: *start Irish Neolithic* (model 2)), probably in *3730–3695 cal BC* (*68% probability*). According to model 3, the Neolithic in Ireland started in *3850–3740 cal BC* (*95% probability*; Fig. 12.57: *start Irish Neolithic* (model 3)), probably in *3815–3760 cal BC* (*68% probability*). The difference between these two models relates basically to how we counteract the scatter on the radiocarbon dates. Model 2 postulates greater scatter, because a large

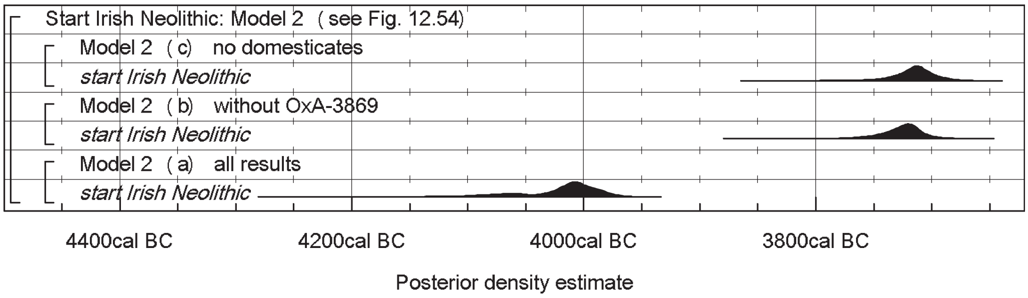

Fig. 12.55. The start of the Irish Neolithic. Posterior density estimates derived from three variants of model 2 (Fig. 12.54), (a) including all dates, (b) without OxA-3869 from Ferriter's Cove, and (c) without the domesticates shown in Fig. 12.42.

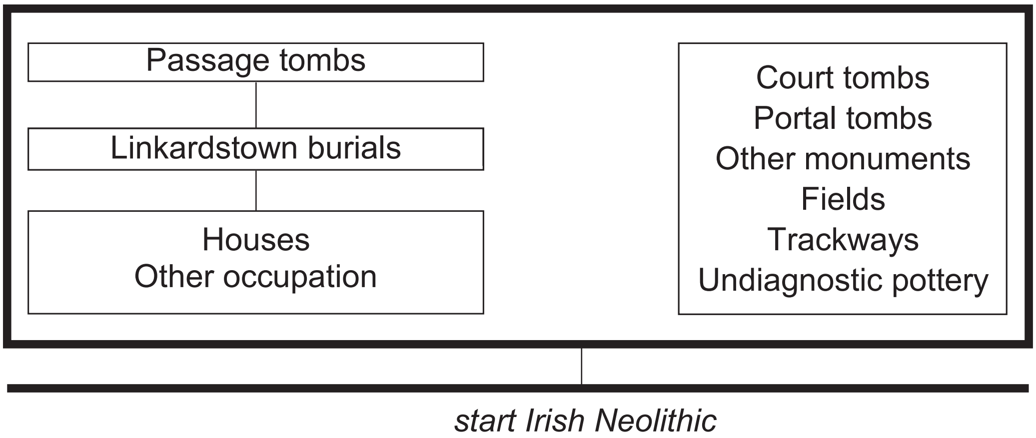

Fig. 12.56. Model 3 of the early and middle Neolithic in Ireland. Outline of another alternative overall model. The components of this model and the conventions used are as Fig. 12.53.

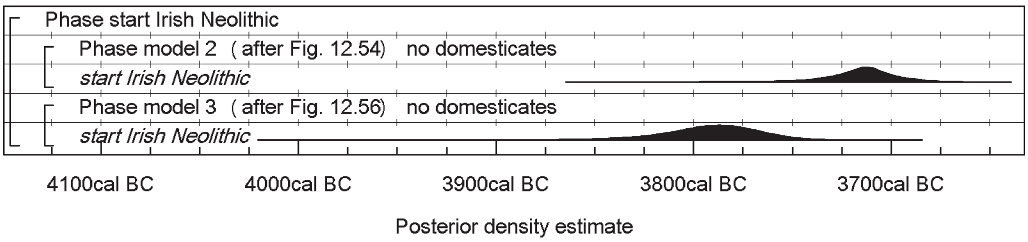

Fig. 12.57. The start of the Irish Neolithic. Posterior density estimates derived from model 2 (Fig. 12.54) and model 3 (Fig. 12.56), without the domesticates shown in Fig. 12.42.

number of dates are available over an extremely restricted chronological span. For this reason, the boundary estimates are more tightly constrained. In contrast, model 3 postulates proportionately less scatter and so these boundaries are pulled in less.

At this stage of research, it is not clear whether either of these models provides an accurate chronology for the introduction of Neolithic things and practices into Ireland. It is a concern that model 2 is biased by a disproportionate number of radiocarbon dates from rectangular houses, which provide more than half of the likelihoods in the uniform phase of early Neolithic activity in Ireland in this model. This could lead the model to over-estimate the scatter on the radiocarbon dates because of a large body of data from a restricted period within the overall phase of activity that is of interest, and thus to provide an estimate for the start of the Irish Neolithic that is too late. We have made no pretence, however, that our consideration of the chronology of the middle Neolithic in Ireland is comprehensive, and so its inclusion in the overall phase in model 3 may also introduce sampling bias, if later deposits are under-represented in our sample. In this case, the lack of a proportionate number of later dates would lead the model to under-estimate the actual statistical scatter at the start of the phase and provide an estimate for the start of the Irish Neolithic that is too early. It must be an urgent priority for Irish archaeology to obtain more dates on short-life samples associated with diagnostic early Neolithic material from contexts other than houses. This may resolve the disparity between the two models. In either case, on the basis of a single radiocarbon measurement on a cow from Kerry, it seems that domesticated fauna may have reached Ireland

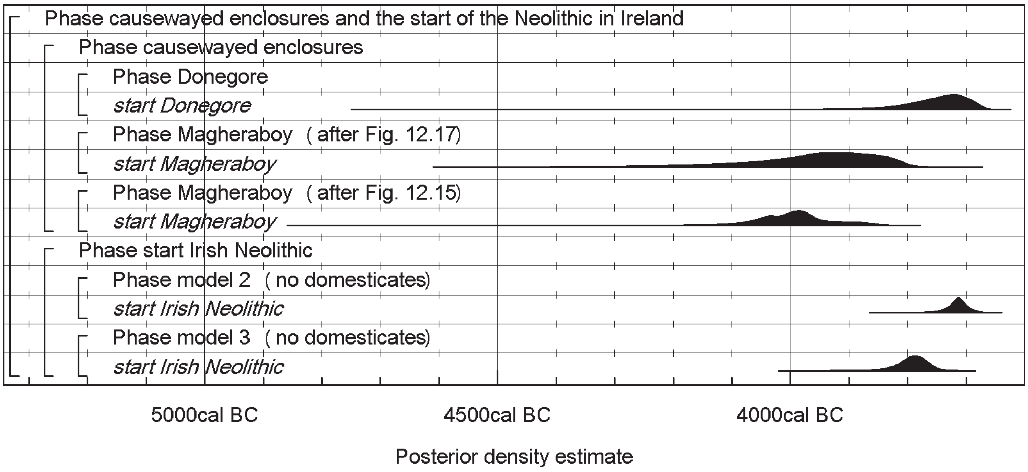

Fig. 12.58. Causewayed enclosures and the start of the Irish Neolithic. Posterior density estimates for the construction of Donegore (Figs 12.5–9) and Magheraboy (Fig. 12.15 and alternatively Fig. 12.17), and for the start of the Irish Neolithic, derived from model 2 (Fig. 12.54) and model 3 (Fig. 12.56), without the domesticates shown in Fig. 12.42.

sporadically for some centuries before Neolithic practices began.

The Magheraboy and Donegore enclosures in their early Neolithic context in Ireland

It is now time to consider the place of causewayed enclosures in the Irish Neolithic. The estimates for the start of the Neolithic in Ireland (models 2 and 3 discussed above) are shown on Fig. 12.58, along with our estimates for the dates when the enclosures at Donegore and Magheraboy were constructed.

It can be seen that the enclosure at Donegore was constructed within a century of the appearance of Neolithic material culture in Ireland. If model 3 is preferred, then enclosures may have appeared a few generations after the initial establishment of new practices. If, however, model 2 is preferred, then Donegore may form part of the first wave of the Neolithic, fitting in with the introduction of a 'Carinated Bowl Neolithic' tradition (Sheridan 2007a). The radiocarbon dates from this enclosure have good agreement with either interpretation. It should be noted again, however, that no short-life samples are available from the basal filling of this enclosure, and so a slightly earlier date is not out of the question.

According to the preferred model for Magheraboy (Fig. 12.15), the enclosure there was built in *4115–3850 cal BC* (*95% probability*; *start Magheraboy*), probably in *4065–3945 cal BC* (*68% probability*). This is significantly earlier than any other unequivocally diagnostic Neolithic element so far dated in Ireland. Although domesticates may have appeared sporadically from the second half of the fifth millennium cal BC, the ditch at Magheraboy is not just of Neolithic form. It also contains diagnostic Neolithic material: Carinated Bowl sherds and a small assemblage of lithics including leaf-shaped arrowheads and an axehead of Antrim porcellanite. The latter came from zone 2, segment 3, where oak sapwood from a charred plank lying on the base of the ditch has been dated (Fig. 12.15: *GrA-31961*). It is therefore difficult to argue that the enclosure at Magheraboy dates to before the introduction of wider Neolithic practices – the Carinated Bowl Neolithic – in the island. Clearly the material connections represented here were already extensive; but these, according to the models presented above, were not demonstrably in place before the 38th century cal BC.

For the reasons given earlier in this chapter, and on the criteria used throughout this volume, the model for the chronology of Magheraboy shown in Fig. 12.15 is to be preferred to the alternative chronological model shown in Fig. 12.17. When this is included as a component of the early Neolithic in model 2 here, however, that model has poor overall agreement ($A_{overall}$=52.2%). Further consideration of the individual indices of agreement indicates that this poor overall agreement is almost entirely caused by *Beta-199985* (A=6.2%). This is a bulk sample of hazel charcoal dated by liquid scintillation spectrometry. If this is interpreted as containing residual material, and the alternative model for the chronology of Magheraboy (Fig. 12.17) is incorporated as a component of the early Neolithic in model 2, then that model has good overall agreement ($A_{overall}$=61.7%). This reading suggests that the early Neolithic in Ireland began in *3840–3730 cal BC* (*95% probability*; Fig. 12.59: *start Irish Neolithic*, model 2), probably in *3810–3750 cal BC* (*68% probability*). Activity at Magheraboy began in *3830–3715 cal BC* (*95% probability*; Fig. 12.59: *start Magheraboy*, model 2 (Fig. 12.17)), probably in *3795–3730 cal BC* (*68% probability*).

If either model for the chronology of Magheraboy is included in model 3, the resultant models have good overall agreement ($A_{overall}$=71.6%: Fig 12.15; and $A_{overall}$=87.8%: Fig. 12.17), although *Beta-199985* still has poor agreement in the preferred interpretation (Fig. 12.15) of the chronology of Magheraboy (A=8.5%). The estimates for the beginning of the Irish Neolithic and the start of activity at Magheraboy calculated by these models are shown in Fig. 12.59. When

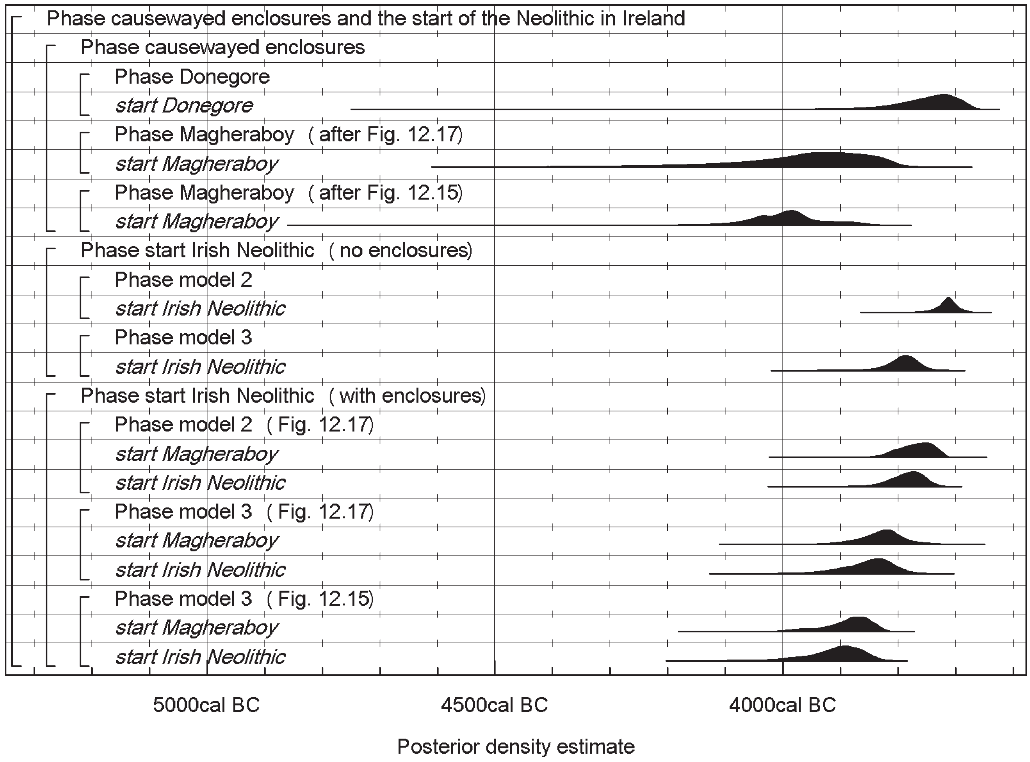

Fig. 12.59. Causewayed enclosures and the start of the Irish Neolithic. Posterior density estimates for the construction of Donegore (Figs 12.5–9) and Magheraboy (Fig. 12.15 and alternatively Fig. 12.17), and for the start of the Irish Neolithic, derived from model 2 (Fig. 12.54) and model 3 (Fig. 12.56), without the domesticates shown in Fig. 12.42. Alternative estimates for the date of the Magheraboy enclosure and for the start of the Irish Neolithic are provided by the version of model 2 (Fig. 12.54) which includes the model from Donegore and the alternative model for Magheraboy (Figs 12.5–9 and 12.17), and by versions of model 3 (Fig. 12.56), including models from Donegore and Magheraboy (Figs 12.5–9 and 12.15), or the model from Donegore and the alternative model for Magheraboy (Figs 12.5–9 and 12.17).

the preferred reading for the chronology of Magheraboy is included in model 3, we estimate that the Irish Neolithic began in *4000–3830 cal BC* (*95% probability*; Fig. 12.59: *start Irish Neolithic*, model 3 (Fig. 12.15)), probably in *3935–3850 cal BC* (*68% probability*). In this model, activity at Magheraboy began in *3980–3820 cal BC* (*95% probability*; Fig. 12.59: *start Magheraboy*, model 3 (Fig. 12.15)), probably in *3910–3835 cal BC* (*68% probability*). If the alternative reading of the chronology of Magheraboy is included in model 3, then the Irish Neolithic began in *3940–3780 cal BC* (*95% probability*; Fig. 12.59: *start Irish Neolithic*, model 3 (Fig. 12.17)), probably in *3880–3800 cal BC* (*68% probability*). In this model, activity at Magheraboy began in *3920–3745 cal BC* (*95% probability*; Fig. 12.59: *start Magheraboy*, model 3 (Fig. 12.17)), probably in *3865–3790 cal BC* (*68% probability*).

Figure 12.59 shows five different estimates for the date when the Neolithic in Ireland began — all derive from models that have good overall agreement, and so are statistically plausible. The estimated dates are, however, contradictory. Not all of these models can be right. Either the preferred chronology for Magheraboy is *importantly wrong* or our models for the introduction of Neolithic practices into Ireland are *importantly wrong* (Box 1979; Bayliss *et al*. 2007a). The basic problem is that the radiocarbon dates from Magheraboy are around 200 years earlier than any other dates for short-life material so far obtained on diagnostically Neolithic activity in the island. This lack of reliable radiocarbon dates falling in the first two centuries of the fourth millennium cal BC casts doubt on the reliability of the preferred chronology for Magheraboy and doubt on models for the Irish Neolithic that include this reading.

As previously noted by Peter Woodman (Woodman *et al*. 1999, 148), it is a real struggle to identify reliable radiocarbon determinations associated with the Irish Neolithic before 5000 BP (*c*. 3800 cal BC). One of the disarticulated bones from Poulnabrone (Fig. 12.31: OxA-1906) may be this early, as might a date on a redeposited cattle bone from Kilgreany Cave (Fig. 12.42: OxA-4269). Neither of these need be more than the expected statistical scatter on an assemblage of dates of this size, and doubts about whether domesticated fauna alone are enough to define the early Neolithic have already been expressed. The date on a person from Sramore Cave (UB-6407; Table 12.13; Fig 12.52) who has a probably largely terrestrial isotopic signature[17] – if such denotes a Neolithic lifeway – is also this early. At this point, early dates on pine charcoal should also be noted (Ballynagilly; Fig. 12.30: UB-197; Croaghaun; Table 12.12: Ua-713, St-10453), although these

fall substantially earlier than the early fourth millennium cal BC, and our concerns about the possibility of re-used bog pine have been noted above.

It can also be noted that models 2 and 3 (in their variants excluding the measurements on domestic fauna shown in Fig. 12.42) include 292 radiocarbon dates; 144 are fully modelled, 149 are included as *termini post quos* only, and nine are included as *termini ante quos* only. Since these models were compiled in 2007, we have become aware of 33 further radiocarbon dates (listed in the other footnotes in this chapter) which are relevant to this study. Of these, 15 can be fully included in the models, five provide *termini post quos* for the end of the primary use of monuments, and 13 relate to later activity on the sites concerned. These results represent an increase of 10% in the most effective part of the dataset that can be fully modelled. The inclusion of these new data, however, alters the outputs of our models by only a decade at the most. The gap between Magheraboy and the other data for the early Neolithic stubbornly remains.

We have not considered the corpus of dated pollen sequences from Ireland at all in this chapter. That has been a task beyond the remit of this project, but it would now be highly informative to compare the radiocarbon dates from peat and other profiles for first, clearance activity, and secondly, reliably identified (if that is possible) cereal pollen, within Bayesian chronological models. OxCal v4 (Bronk Ramsey 2009a) and BPeat (Blaauw and Christen 2005) now allow more sophisticated modelling of processes such as peat accumulation rates (Blaauw *et al*. 2003; Christen *et al*. 1995), so that more robust models of the timescales of clearance and/or cultivation episodes should now be within reach. That is for the future. In the meantime, it is worth noting that dated pollen diagrams are skewed towards the north and west of Ireland. Appraisal of the available evidence tends to scepticism about most identifications of pre-elm decline cereal pollen (Monk 1993, 41–3; O'Connell and Molloy 2001, 117–18). Convincing cereal pollen from immediately below the elm decline (and a major clearance episode) at Lough Sheeauns, Connemara, is already within the early fourth millennium cal BC (Molloy and O'Connell 1987). Disturbances to woodland vegetation, not necessarily the outcome of activity by Neolithic people, occurred before the elm decline (taken by O'Connell and Molloy as a near-synchronous horizon in Ireland, occurring *c*. 3900 cal BC). Woodland disturbances were more numerous after the elm decline, when they are often associated with cultivation and/or pasture, and when the centuries-long duration of some *landnam* events, like that at the Céide Fields, suggests sustained settlement (O'Connell and Molloy 2001, 117–24). The informal chronologies for this evidence accord with all the varying start dates for the Irish early Neolithic presented here (Fig. 12.59).

For all these reasons, the dating model for Magheraboy must be re-examined. We have already suggested that *Beta-199985* and other bulk short-life samples from the ditch might have contained older, residual material (Fig. 12.17), and we might further suggest that the oak plank dated by *GrA-319161* could have been re-used. It should be noted that there are no dates on samples of cereals or domesticated animals from the ditch itself, and the one date on cereals from a pit in the interior (Table 12.2: Beta-196298), as well as some of those on charred hazelnut shell and hazel charcoal from other pits (Table 12.2: Beta-186484, -197649, -197653, -196299) are later than dates from ditch contexts and are in line with the date estimates for the Irish early Neolithic given in models 2 and 3 (Fig. 12.14). All these arguments could be made – and the need to date more samples from the site has already been emphasised. Compared with all the models considered throughout this volume, this may sound like special pleading, all the more so since the ditch dates are very consistent. At this point, however, we need to resolve a fundamental incompatibility between the Magheraboy dating and the weight of other evidence presented in this chapter. Special pleading which invokes some residual charcoal and a re-used plank may be the price to pay.

Alternatively, perhaps Magheraboy was an isolated, short-lived episode. Just as the first appearance of cattle in Ireland may have been sporadic and perhaps without immediate consequences (Woodman *et al*. 1999, 146–51; Woodman 2000, 230–43), so there is the possibility that the enclosure at Magheraboy represented a localised innovation in the context of wider cultural influences, perhaps with connections again to north-west France (and see Chapter 15.6), but again without longer-term effects.

The basic difficulty with this interpretation of Magheraboy is the evidence there for activity, material culture and connections of kinds typically represented elsewhere in the early Neolithic of Ireland. Ditch digging, palisade construction, and perhaps the building of a rectangular structure (Fig. 12.11); the use of leaf-shaped arrowheads and Carinated Bowl pottery; and the use of porcellanite from Antrim on the other side of the island; are all instances from the enclosure circuit itself of this typicality. One might make a more complicated case that leaf-shaped arrowheads and Carinated Bowl pottery might be sufficiently generic in character as to belong to other, wider cultural traditions, encompassing north-west France and perhaps beyond. The presence of a porcellanite axehead, however, as a distinctive feature of Neolithic practice and tradition, certainly in the northern part of the island, seems on the face of things to demand the existence of the rest of the early Neolithic in Ireland. This too, like every other element, has to be questioned. There has been more research in recent years on the Group IX sources, Brockley on Rathlin Island showing more extensive activity than previously known (Cooney *et al*. forthcoming), but the chronology of extraction and working can so far only be inferred from the contexts of the products elsewhere. In contrast, the working of the porphyry source at Eagle's Nest, Lambay, has been dated, apparently to a short period in the 38th to 37th centuries cal BC in the early Neolithic (Fig. 12.30). How key a role then did organised axehead production play in the process of Neolithisation

(see Cooney 2008)? Further research on the porcellanite (and other) axehead sources must be another priority, but if Lambay is typical, they do not seem to have been active before the 38th century cal BC.

The discussion about Magheraboy has also to be set in the context of the wider issue of the date for the beginning of the early Neolithic in Ireland. We will follow the wider implications of these possibilities set out above in Chapters 14 and 15, when the chronological evidence from southern Britain is set alongside that from Ireland, Scotland and the European continent.

It should be clear from these discussions that there are still significant problems in deciding on when Neolithic practices in Ireland began. Leaving Magheraboy to one side, the evidence currently available may best be accommodated by a beginning in the 38th century cal BC. Models 2 and 3 estimate the start of the Irish Neolithic within this century, although they disagree as to when precisely this transition occurred (Fig. 12.59). The informal dating currently available for the pollen evidence does not contradict this suggested start date.

The models presented here represent a step forward. Despite their difficulties and uncertainties they represent formal, quantitative models for the chronology of one of the major social transitions in Ireland. Models 2 and 3 (Figs 12.54, 12.56, 12.59), which we feel are the least implausible, are contending between a few generations within a single century. But the fact remains that we still do not know when the Neolithic came to Ireland! And this matters.

Archaeologically, there are significant differences between these readings. If model 3 is correct, then the early Neolithic in Ireland began at the end of the 39th century cal BC or in the first half of the 38th century cal BC and, a few generations later, large numbers of substantial timber houses and perhaps enclosures were constructed. A few generations or a lifetime later again, these houses ceased to be built or used. In this reading, the introduction of the Neolithic to Ireland is a cumulative process, albeit a relatively rapid one. If model 2 is correct, however, then Neolithic practices were introduced into Ireland even more rapidly, with houses, enclosures, and other occupation associated with diagnostic early Neolithic material appearing all at once in the generation before 3700 cal BC. The differences between these chronologies are subtle – in human terms perhaps between the span of a lifetime and that of a generation – but the contrasting rates of change suggested have profound implications for explanations of how the Neolithic began in Ireland and the experience of those who lived through the transition.

This chapter has provided more questions than answers. It began with the task of providing date estimates for the enclosures at Donegore and Magheraboy (Fig. 12.59). Donegore appears to have been built in the 38th century cal BC, and Magheraboy in the 40th century cal BC in our preferred model (Fig. 12.15). To put both into context, we have used existing radiocarbon dates from a range of sites to model the early Neolithic in Ireland as a whole and selected features from the start of the middle Neolithic. That has suggested two principal models for the date of the start of the Irish Neolithic, in the first half and the second half respectively of the 38th century cal BC (Fig. 12.59). That presents interesting alternatives for the place of Donegore in the early generations of the Irish Neolithic, and thus the nature and rate of change. In its own right, however, its date is very interesting compared to those of enclosures in southern Britain: a theme which we will follow further in Chapters 14 and 15. It is the dating of the Magheraboy enclosure which raises fundamental problems.

Despite all these uncertainties, we would like to end on the positive note of key priorities for the future. This chapter has demonstrated not just how much we do not know about the chronology of the Irish Neolithic, but how much we do know. There is a substantial body of data already available and assessed in detail here, and more key sets of data are becoming available. Resolution of some key questions is within sight, if just beyond our immediate grasp. To resolve them, the agenda for the next decade of Neolithic research in Ireland must include: further dating of the enclosure and diagnostic Neolithic material culture at Magheraboy; the investigation of other possible enclosures; extensive dating of occupation and activity contexts other than houses; further dating of short-life samples from houses themselves; incorporation of environmental sequences into chronological models; further dating of short-life samples relating to the construction and primary use of monuments; and further investigation of the exploitation of porcellanite and other axehead sources. The list could go on: there is no shortage of things to do!

Notes

1 Note added in press: see now Whitehouse *et al.* (2010).

2 Since the modelling for this chapter was completed, a radiocarbon date has become available. Charcoal, identified as probably ash, from the sealing deposit has given a date of 3650–3510 cal BC at 95% confidence (4784±32 BP: Wk-18170) (D. Moore 2009).

3 Two further potential Neolithic enclosures are a sub-oval enclosure, approximately 40 m across, at Ballycreggy, Co. Antrim, revealed by top-soil stripping in advance of road widening by ADS Ltd in June 2009 (http://www.roadsni.gov.uk/m2link-archaeology-01.pdf), and a sub-D-shaped enclosure, approximately 100 m across, revealed by geophysics at Rossnaree, Co. Meath, during survey in the Brú na Bóinne World Heritage Site (Brady 2009).

4 Two samples of charred seeds from posthole F43 and the east end of the east wall trench respectively provided dates of 3950–3670 cal BC (95% confidence; UBA-8570; 5005±42BP) and 3800–3650 cal BC (95% confidence; UBA-8571; 4948±32BP) (Conor McDermott, pers. comm.).

5 These date estimates are basically compatible with those provided by McSparron (2008, figs 4–5), who produced a similar Bayesian model based on the measurements on short-life samples then available. His estimate for the time when the use of these structures came to an end is a few decades earlier than the estimate presented here, because he did not incorporate all the samples with potential age-offsets into his model as *termini post quos*.

6 A human phalanx from the surface in the open chamber of Ballynacloghy, Co. Galway, provided a date of 3700–3520 cal BC at 95% confidence (4835±39 BP; UB-6694). Cremated bone excavated from the back chamber II at Ballyrenan, Co. Tyrone (O. Davies 1937), was dated to 2290–2030 cal BC at 95% confidence (3743±36 BP; UB-6706). A piece of cremated human skull excavated from the disturbed eastern part of the chamber of the tomb at Drumanone, Co. Roscommon (Topp 1962), provided a date of 2140–1890 cal BC at 95% confidence (3639±37 BP; UB-6696) (Kytmannow 2008, table 7.1).

7 A further sample of unidentified charcoal from the base of the spread of cairn material on the north side of the monument (3475±40 BP; GrN-11432) provides a *terminus post quem* of 1900–1680 cal BC (95% confidence) for the slippage of the cairn (O'Kelly 1958, 40; 1989, 90–1) (Kytmannow 2008, table 7.3).

8 A further determination on human bone from this monument was reported after the modelling undertaken here (95% confidence; 4556±35 BP; 3490–3100 cal BC; UB-6741) (Kytmannow 2008, table 7.2). This falls comfortably within the currency of court tombs suggested here (Figs 12.32–4).

9 An, apparently otherwise unpublished, date on unidentified bulk charcoal from the façade at Dunloy, Co. Antrim (UB-3533; Kytmannow 2008, table 7.2), and a series of dates on unidentified bulk charcoal samples from Rathlackan, excavated by Gretta Byrne (Beta-48102, -63836, -76583–91; Kytmannow 2008, table 7.3; Byrne *et al.* 2009, 25), add little to our reported model. A date of 3640–3375 cal BC (95% confidence; 4737±35 BP; UB-6742), from Ballyedmond, Co. Down (Kytmannow 2008, table 7.3), again falls within the currency of court tombs suggested by our model (Figs 12.32–4). A series of seven measurements, five of them on short-life species of charcoal, from Behy, Co. Mayo are also consistent with a currency of court tombs including the middle centuries of the fourth millennium cal BC (the dates definitely on short-life charcoal samples are 3660–3370 cal BC (AA-43428; 4790±55BP), 3700–3380 cal BC (AA-43429; 4805±55BP), 3640–3350 cal BC (AA-43430; 4685±55BP), 3520–3090 cal BC (UCD-118; 4580±60BP), and 3640–3340 cal BC (UCD-142; 4680±70BP); AA-43416 (3970–3640 cal BC; 5005±75BP) was on oak charcoal, and UCD-141 (3630–3100 cal BC; 4610±60 BP) contained a component of oak and so could have an age-at-death offset from the contexts from which they derived). Two Early Bronze Age dates from Aghanaglack (UB-6730–1, 3433±39BP and 3446±38BP; Kytmannow 2008, table 7.3) presumably relate to the later use of the monument.

10 The date recently obtained from Ballynacloghy, Co. Galway (UB-6694; see note 6), does not change this interpretation substantively.

11 More recent work reported by Kytmannow (2008, 100–16) has perhaps added two further dates relating to the primary use of court tombs (UB-6741–2; see notes 7 and 8 above), the other additional dates reported by her either being *termini post quos* or relating to later use.

12 Given the strong evidence for the utilisation of marine fish and shellfish at Ferriter's Cove and the absence of practically any evidence for the exploitation of freshwater fish (99.8% of the fish bones were from marine species), we feel that this approach is reasonable (Woodman *et al.* 1999, chapter 6). Such simple linear interpolation of diet from stable isotopic values appears to be effective in cases where diet is dominated by a few extremely prominent components (Arneborg *et al.* 1999; Cook *et al.* 2001; Van Strydonck *et al.* 2009), although more complex mixing models may be required for mixed diets without a dominant protein source (e.g. Focken and Becker 1998; Phillips and Gregg 2003; Focken 2004; Bayliss *et al.* 2004; Beavan Athfield *et al.* 2008). It should be noted that seafood caught in the vicinity of Ferriter's Cove is likely to have a fully marine isotopic signature (unlike such resources from the Baltic which has more in common with a complex estuarine environment; cf. Brinch Petersen and Meiklejohn 2009).

13 The dates on the fish-baskets are 5040–4800 cal BC (Beta-231947, 6030±40BP), 5000–4720 cal BC (Beta-231948, 5970±50BP), 5000–4720 cal BC (Beta-231949, 5970±50BP), 5210–4800 cal BC (Beta-231950, 6060±50BP), 5060–4790 cal BC (Beta-231951, 6030±50BP), 5220–4940 cal BC (Beta-231952, 6130±40BP), 5060–4790 cal BC (Beta-231953, 6030±50BP), 5220–4950 cal BC (Beta-231954, 6140±40BP), 5000–4720 cal BC (Beta-231955, 5980±50BP), 5200–4800 cal BC (Beta-231956, 6050±50BP), 5310–4990 cal BC (Beta-231957, 6190±50BP), and 5220–4990 cal BC (Beta-231958, 6160±40BP). Further details, but no $\delta^{13}C$ values, are provided by E. O'Connor (2008, appendix 1).

14 Dates from Annagh Cave, Co. Limerick (Dowd 2008, 308; Ó Floinn 1992), may be relevant here, depending on the security of association between the five dated burials, some articulated and some disarticulated, and the two complete pots (a decorated bipartite bowl and a decorated hemispherical bowl), placed on a ledge above two of them. Right scapulae from five adult males provided radiocarbon dates of 3640–3190 cal BC (95% confidence; GrA-1703; 4670±70 BP, −20.9‰), 3660–3370 cal BC (GrA-1704; 4780±60 BP, −19.8‰), 3710–3370 cal BC (GrA-1707; 4810±60 BP, −20.1‰), 3630–3130 cal BC (GrA-1708; 4640±60 BP, −20.6‰) and 3710–3510 cal BC (GrA-1709; 4840±60 BP, −21.0‰). These results are statistically consistent ($T'=8.1$; $T'(5\%)=9.5$; $\nu=4$), which suggests that this episode of burial may have been of limited duration.

15 A further dating programme for some of the Knowth passage tombs is currently underway (Rick Schulting, pers. comm.).

16 See again note 15.

17 The $\delta^{13}C$ value available for this burial is −20.1‰, which probably indicates a largely terrestrial-based diet. This valued was measured, however, by AMS, which means that it will include any fractionation induced in the graphitisation and measurement process as well as the natural isotopic ratio of the sample itself.

13 Carbon and nitrogen stable isotope values of animals and humans from causewayed enclosures

Julie Hamilton and Robert E.M. Hedges

13.1 Introduction

The analysis of stable isotopes in bone collagen is a well established technique in the study of palaeodiet (e.g. R. Hedges *et al*. 2007b; Jay and Richards 2006; 2007; Müldner and Richards 2007; Privat and O'Connell 2002). It is based on the principle that the isotopic composition of body tissues of animals and humans reflects the isotopic composition of their diets ('you are what you eat'). The isotopic composition of herbivore collagen will reflect that of the plants at the base of the food chain, which has not yet been directly measured for archaeological material, and the isotopic composition of carnivores will reflect that of their prey.

The relative abundance of the stable isotopes of carbon ^{13}C and ^{12}C ($\delta^{13}C$) differs clearly between plants with different photosynthetic pathways, and is clearly higher in marine than terrestrial ecosystems. Collagen $\delta^{13}C$ increases by *c*. 1‰ with each step up the food chain (trophic level) (Bocherens and Drucker 2003).

The ratio between the stable isotopes of nitrogen ^{15}N and ^{14}N ($\delta^{15}N$) increases with each trophic level by 3–5‰ (Bocherens and Drucker 2003; Hedges and Reynard 2007; Sponheimer *et al*. 2003). $\delta^{15}N$ values in plants depend on nitrogen cycling in the soil, and so are less predictable than $\delta^{13}C$ values, and in studies of human diet they are generally inferred from the herbivore values. Fish and mammals in marine ecosystems frequently have considerably higher $\delta^{15}N$ values than terrestrial herbivores, in part because of the longer food chains, so high values (i.e. enriched in the heavier isotope) for both $\delta^{13}C$ and $\delta^{15}N$ would be interpreted as indicating the use of marine resources. On the archaeological and isotopic evidence so far available, there was very little if any use of marine resources during the Neolithic in southern Britain (R. Hedges *et al*. 2007b; M. Richards 2000; M. Richards *et al*. 2003). A small amount of freshwater fish in the diet, however, might raise $\delta^{15}N$ values without much affecting $\delta^{13}C$, and cannot be discounted on isotopic grounds.

Because the trophic enrichment for ^{15}N is relatively large, it can be used to estimate the proportion of collagen protein that is derived from animal sources (assuming no fish in the diet). For omnivores such as humans, collagen $\delta^{15}N$ for someone who ate no animal products should be similar to herbivore values, while for someone who ate no plant protein it should be this plus 3–5‰. Values between these extremes reflect the relative amounts of protein from animal and plant sources. So far, values for the enrichment of $\delta^{15}N$ in human bone collagen ($\Delta^{15}N_{\text{human-fauna}}$) for the British Neolithic have been at least 4‰, which on the simplest assumptions suggests that at least 80% of collagen protein is from animal sources. This is unexpectedly high, and rather small adjustments in assumptions can change the estimate considerably (reviewed by Hedges and Reynard 2007). It is clearly interesting to see whether $\delta^{15}N$ for humans from causewayed enclosures is similarly high. Such a value would imply that about 50% of calories in the diet were from animal sources, either meat or dairy, which are isotopically indistinguishable.

There are also more subtle environmental influences on herbivore isotopic composition.

$\delta^{13}C$ of plants may be affected by climatic variation, both on a regional, long-term scale (Van Klinken *et al*. 1994; 2000) and at more local, shorter-term scales in response to temperature, water availability and altitude (Heaton 1999). Plants and tree leaves from the lower parts of closed-canopy forests commonly have $\delta^{13}C$ values 2–5‰ lower than vegetation in nearby open areas (Broadmeadow and Griffiths 1993; van der Merwe and Medina 1991), the 'canopy effect', and this has been suggested as an explanation of, for example, the generally lower $\delta^{13}C$ values for aurochs compared to domestic cattle in Denmark (Noe-Nygaard *et al*. 2005) and at Ascott-under-Wychwood (R. Hedges *et al*. 2007b; Stevens *et al*. 2006). However, most contemporary studies demonstrating a canopy effect have been in hotter environments and are often based on comparisons between rather than within species; a comparison of populations of red deer in various temperate environments (Stevens *et al*. 2006), did not find evidence

of a canopy effect. As noted above, plant $\delta^{15}N$ values are affected by nitrogen cycling in the soil, and have also been shown to vary with environmental factors such as temperature and water availability (Ambrose 1991; Dawson *et al*. 2002; Sealy *et al*. 1987).

Variability in isotopic compositions of herbivore tissues will reflect these variations in plant isotopic composition via food and/or habitat selection by animals or by people managing them. There will also be inter-individual variation due to metabolic factors (e.g. genetics, growth, lactation, disease). The timescale of variation may also be important, ranging from centuries or decades to days or hours for both environmental and individual factors. Bone collagen has a relatively slow turnover time and probably averages the diet (and other variation) over a few seasons to several years in herbivores and humans (R. Hedges *et al*. 2007a; Stenhouse and Baxter 1979; Ubelaker *et al*. 2006).

Some of the variation in herbivore isotopic composition may be explicable by these effects, but the system is complex and not well characterised. Faunal data can best be used comparatively, looking for differences in (mean) values in large datasets that can be consistently related to environmental conditions or agricultural management. For the British Neolithic, where all plants are likely to use the C_3 photosynthetic pathway, the ranges of variation in $\delta^{13}C$ and $\delta^{15}N$ that we are trying to explain are around 1–3‰, not large in comparison with measurement and statistical errors. Interestingly, it is at least as wide in herbivores as in more omnivorous humans, which should perhaps make one cautious in attributing differences within human populations to different levels of carnivory.

When comparing and interpreting differences between sites in these sorts of ways, we are making several assumptions:

1. When comparing faunal and human values, we are assuming that the animals from the same site are more likely to be representative of those people's diets than animals from another site.
2. That the fauna at a site reflect 'local' conditions, while leaving the actual geographical scale rather vague – 5, 10, 20 km from the site? The causewayed enclosures may be sites of assembly rather than settlement, and the animals deposited there might represent a variety of management regimes.
3. Even where radiocarbon suggests relatively short phases of use of the sites, this could well be decades, and many animal generations, with potential for change over that time. At Ascott-under-Wychwood, for instance, the cattle from pre-barrow and barrow construction phases differed in mean $\delta^{13}C$ (R. Hedges *et al*. 2007b). The samples used here were selected to come from a relatively short timespan to avoid this problem, but it should be borne in mind when making comparisons with other sites which may have different dates and durations of use.

13.2 Aims

The aims of this project were:

1. To document animal C and N isotopic variation at causewayed enclosures as thoroughly as possible. Existing data suggest some patterns which may be common and may reflect environment and/or husbandry practices.
2. To get a measure of the average range of human $\delta^{15}N$ values from causewayed enclosures to compare with existing data from chambered tombs.
3. To measure the difference in human and animal $\delta^{15}N$ for the same site at as many sites as possible, to investigate trophic level.

13.3 Sampling strategy

To pursue these aims, we wished to sample from sites with both human and large collections of animal bone, and from the early phases of use of the enclosures to avoid confusion due to changes over time. Up to 20 samples per species of the major domestic animals (cattle, sheep, pig) and as many as possible human samples would be taken. The five sites that seemed to fulfil the criteria were Abingdon, Etton, Staines, Windmill Hill and Chalk Hill, Ramsgate. In the event no samples from Staines and only about a third of those from Etton yielded enough collagen, and there were no human samples from Abingdon. Pigs at Chalk Hill and sheep at Etton were relatively rare, so sample numbers for statistical analysis were rather unbalanced, limiting what could sensibly be inferred.

13.4 Methods

Samples were selected from a variety of contexts available from the appropriate phase of the site, preferably using cortical bone from different mature individuals, though it was not always possible to be certain of this. Collagen was extracted from up to 1 g of bone per sample using a standard protocol (O'Connell and Hedges 1999). Any superficial material was removed from the bone by shotblasting, then samples were demineralised in 0.5M HCl at 4°C, rinsed with distilled water, and gelatinised in a pH 3 solution for 48 h at 75°C. The solution was filtered, frozen and freeze-dried. Between 2.5 and 3.5 mg of dried collagen was loaded into a tin capsule for continuous flow combustion and isotopic analysis. Samples were isotopically analysed using an automated Carlo Erba carbon and nitrogen elemental analyser coupled with a continuous flow isotope ratio monitoring mass spectrometer (PDZ Europa Geo 20/20 mass spectrometer). Each sample was measured in at least duplicate and where possible triplicate runs, using internal secondary standards (nylon and alanine), giving an analytical error of ±0.2‰. The pooled estimate of standard deviation, including both measurement and random error, is 0.43‰ for $\delta^{13}C$ and 0.41‰ for $\delta^{15}N$, giving 95% confidence limits for any given sample mean

of ±0.5‰. Results are reported in unit per mil (‰) and $\delta^{13}C$ and $\delta^{15}N$ values were measured relative to the VPDB and AIR standards respectively (Gonfiantini *et al*. 1990; Mariotti 1983). Samples with C:N ratios outside the range 3.1–3.4 or with less than 1% collagen yield (weight % of whole bone) were rejected; accepted samples with <2% collagen yield had acceptable weight % of nitrogen and carbon in their collagen as well as acceptable C:N ratios (Ambrose 1990; DeNiro 1985). Two samples were also excluded because they were not certainly from early phases of use or had been mislabelled, and one because it showed clear pathology (bone deposition in marrow cavity, possibly a response to infection).

A few additional isotope ratios were obtained during radiocarbon measurements. The details of sample preparation for radiocarbon measurement are slightly different, and these measurements are not replicated, so to avoid any possible systematic variation they have not been included in the overall analysis. Data were analysed using standard SPSS and Excel statistical packages.

13.5 Results

Results are shown in Tables 13.1–4 and summarised in Table 13.5 and Fig. 13.1. Each value is the mean of 2 or 3 measurements.

Collagen preservation

Collagen preservation differs between sites. None of the 25 samples from Staines yielded enough collagen. The range of collagen yields was greatest at Etton, where 45 of 65 samples failed, but 6 had yields >10%. This reflects the differential extent and continuity of waterlogging across the site. Only 2 of 58 samples from Abingdon, on river gravels, were rejected, but a higher proportion yielded only 1–2% collagen than at the two chalkland sites, Chalk Hill and Windmill Hill. C:N ratios were well within the accepted range (Tables 13.1–4), showing that collagen was well preserved, and results from replicate runs were in good agreement.

Fauna

Within-species variation

The range of animal $\delta^{13}C$ and $\delta^{15}N$ values is generally 1–3‰, and standard deviations of per-site means for each species were typically around 0.5 (*n*s 3–20; see Table 13.5), though rather higher for $\delta^{15}N$ of all fauna at Etton (with lower sample numbers) and $\delta^{15}N$ of sheep and pig at Windmill Hill. There are a few outliers with values >2 standard deviations from the mean: at Abingdon, one cattle individual with high $\delta^{15}N$ (AB34); at Chalk Hill, one sheep with high $\delta^{15}N$ (CH22); and at Windmill Hill, one sheep with both high $\delta^{13}C$ and $\delta^{15}N$ (WH6), one sheep with low $\delta^{15}N$ (WH3) and a pig with high $\delta^{15}N$ (WH57). WH57 was recorded as 'possibly juvenile', so the high $\delta^{15}N$ may represent a milk signal, but there are no obvious reasons for the other unusual values.

Between-species variation

There are consistent differences between the three major

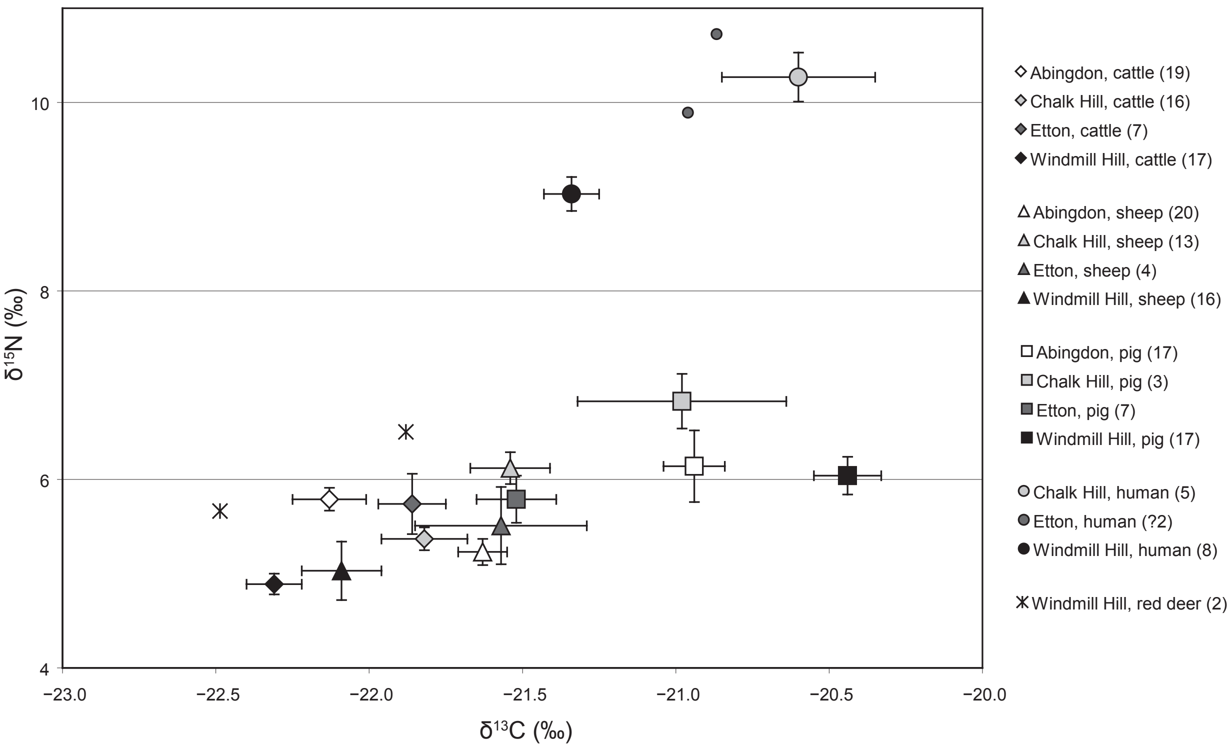

Fig. 13.1. Means ± 1 standard error for human and animal isotope values from causewayed enclosures (n in parentheses). Individual points are shown for Etton humans and Windmill Hill red deer.

Table 13.1. Stable isotope values from Abingdon causewayed enclosure.

RLAHA sample number	Site reference	Species	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N ratio	Collagen (%)
AB1	AB C2 9 1	Sheep	−22.0	5.3	3.3	7.5
AB2	AB C2 9 8	Sheep	−21.2	5.0	3.2	5.6
AB3	AB C2 27 17	Sheep	−21.7	3.9	3.3	2.3
AB4	AB C2 29 19	Sheep	−21.7	5.2	3.3	3.5
AB5	AB C2 29 20	Sheep	−21.9	5.4	3.3	3.3
AB6	AB C2 24 33	Sheep	−21.6	4.5	3.2	3.3
AB7	AB C2 24 35	Sheep	−21.5	5.2	3.3	4.2
AB8	AB C2 24 37	Sheep	−22.0	5.2	3.3	4.6
AB9	AB C2 26+23N 42	Sheep	−21.1	4.6	3.3	2.3
AB10	AB C2 26+23N 43	Sheep	−20.9	5.6	3.3	6.2
AB11	AB C2 26+23N 44	Sheep	−21.4	5.1	3.3	11.4
AB12	AB C2 4 56	Sheep	−22.1	5.1	3.3	1.3
AB13	AB C2 4 57	Sheep	−21.8	5.9	3.3	3.1
AB14	AB C2 4 58	Sheep	−21.5	5.9	3.2	4.9
AB15	ABCE C2 5 6	Sheep	−21.3	4.5	3.2	3.3
AB16	AB B3 3 226	Sheep	−22.2	6.5	3.2	2.4
AB17	AB B3 3 226	Sheep	−21.7	6.1	3.3	2.2
AB18	AB C2 33A	Sheep	−21.5	5.0	3.3	6.0
AB19	AB C2 33A	Sheep	−21.5	4.9	3.2	3.9
AB20	AB C2 34	Sheep	−22.0	5.8	3.2	3.7
AB22	AB C2 4 27	Cattle	−22.0	5.4	3.2	2.3
AB23	AB C2 8 2	Cattle	−21.6	6.1	3.2	3.0
AB24	AB C2 9 1	Cattle	−22.6	5.2	3.3	3.4
AB25	AB C2 11 4	Cattle	−23.2	5.5	3.1	1.0
AB26	AB C2 24 21	Cattle	−22.2	5.7	3.2	1.3
AB27	AB C2 24 22	Cattle	−22.5	5.5	3.3	1.0
AB28	AB C2 24 16A	Cattle	−22.1	6.0	3.2	1.8
AB29	AB C2 26+33A 17	Cattle	−22.4	5.2	3.2	1.5
AB30	AB C2 29 11	Cattle	−22.6	5.9	3.2	1.1
AB31	AB C2 29 12	Cattle	−22.0	5.6	3.3	3.0
AB32	AB C2 33 5	Cattle	−22.1	5.6	3.2	1.3
AB33	AB C2 28+33B 8	Cattle	−21.7	6.1	3.3	3.3
AB34	AB C2 33+28 9	Cattle	−22.7	7.3	3.2	2.5
AB35	AB C2 51 5	Cattle	−21.0	5.4	3.3	7.4
AB36	AB C2 36 2	Cattle	−21.1	6.3	3.3	2.9
AB37	AB C2 41 4	Cattle	−22.3	5.4	3.2	2.0
AB38	AB B3 3 226	Cattle	−21.8	6.7	3.2	3.5
AB39	AB 26+23N C2 27	Cattle	−22.5	5.8	3.1	1.8
AB40	AB B3 3 226	Cattle	−22.2	5.4	3.2	2.0
AB41	AB 37 C2 1	Pig	−21.4	6.0	3.2	2.3
AB42	AB 27 C2 28	Pig	−20.6	6.0	3.2	3.1
AB43	AB B3 226 3	Pig	−21.9	6.0	3.2	3.7
AB45	AB C2 10 22	Pig	−20.7	6.3	3.2	1.6
AB46	AB 26+23N C2 27	Pig	−20.6	6.5	3.3	4.1
AB47	AB 26+23N C2 28	Pig	−21.2	6.4	3.2	2.3
AB48	AB C2 33+28 31	Pig	−20.7	6.0	3.4	1.3
AB49	AB C2 24 32	Pig	−20.9	6.2	3.2	3.0
AB50	AB 28+33B 40	Pig	−20.7	5.4	3.4	2.6
AB51	AB 28+33B C2 41	Pig	−20.7	5.5	3.2	2.2

AB52	AB C2 23A 42	Pig	−20.6	6.0	3.3	2.8
AB53	AB C2 24 50	Pig	−21.2	6.5	3.4	1.8
AB54	AB C2 24 51	Pig	−21.5	5.7	3.3	1.2
AB55	AB C2 24 53	Pig	−21.0	6.4	3.4	1.5
AB56	AB C2 24 54	Pig	−21.1	6.0	3.3	1.7
AB57	AB C2 4 73	Pig	−20.4	6.6	3.3	3.8
AB58	AB C2 4 74	Pig	−20.8	6.8	3.2	1.8

Table 13.2. Stable isotope values from Chalk Hill, Ramsgate, causewayed enclosure.

RLAHA sample number	**Site reference**	**Species**	**$\delta^{13}C$ (‰)**	**$\delta^{15}N$ (‰)**	**C:N ratio**	**Collagen (%)**
CH1	F968/1193	Cattle	−21.7	5.7	3.2	7.8
CH2	F968/1193	Cattle	−21.2	5.1	3.2	4.9
CH3	F968/1193	Cattle	−21.3	5.8	3.2	3.1
CH4	F1215/1450	Cattle	−21.5	6.0	3.2	7.1
CH5	D2 F1143/1256	Cattle	−22.5	4.3	3.2	5.0
CH6	D F1146/1273	Cattle	−21.0	5.4	3.2	6.4
CH7	D2 F1287/1262	Cattle	−21.5	5.1	3.3	6.8
CH8	Tr20 F65/59	Cattle	−22.4	5.8	3.2	5.6
CH9	Tr20 F74/63	Cattle	−22.0	5.2	3.2	4.5
CH10	F1421/1259	Cattle	−21.7	5.5	3.2	9.2
CH11	F1421/1259	Cattle	−22.8	6.3	3.2	3.6
CH12	F1421/1259	Cattle	−21.5	5.5	3.2	4.7
CH13	Tr20 F65/59	Cattle	−21.4	5.3	3.2	3.3
CH14	Tr20 F65/59	Cattle	−21.5	5.2	3.2	2.5
CH15	F1303/1473	Cattle	−22.5	4.8	3.2	1.9
CH20	D2 F1162/1259	Cattle	−22.7	5.1	3.2	1.2
CH21	Tr20 F55/45	Sheep	−21.2	5.8	3.3	3.1
CH22	Tr20 F57/57	Sheep	−22.5	7.5	3.3	4.5
CH23	Tr20 F68/61	Sheep	−21.9	5.6	3.3	3.1
CH24	D2 F968/1193	Sheep	−20.7	6.1	3.2	8.5
CH25	F1017/1217	Sheep	−21.7	6.4	3.3	1.7
CH26	F1354/1228	Sheep	−21.5	6.5	3.2	3.9
CH27	F1354/1228	Sheep	−21.7	6.3	3.3	3.5
CH28	D2 F1162/1259	Sheep	−21.8	6.3	3.2	3.0
CH29	F1166/1313	Sheep	−21.5	4.9	3.2	5.3
CH30	F1281/1334	Sheep	−21.8	5.8	3.3	3.9
CH31	F1289/1346	Sheep	−20.8	6.1	3.3	2.2
CH32	9802/1473	Sheep	−21.5	6.4	3.3	2.2
CH33	9802/1473	Sheep	−21.6	5.8	3.3	3.0
CH34	Tr20 F58/55	Pig	−20.3	7.2	3.3	3.2
CH35	Tr20 F58/55	Pig	−21.5	7.0	3.3	2.4
CH36	Seg7 F1574/1586	Pig	−21.1	6.3	3.3	3.5
CH37	Tr20 F68/61	Human	−20.2	10.8	3.3	6.3
CH38	D2A F1309/1538	Human	−20.1	10.7	3.3	3.0
CH39	D2 F1120/1232	Human	−21.0	9.6	3.2	4.5
CH40	D2A F1309/1538	Human	−21.3	9.7	3.2	3.8
CH41	D2 F1301/1336	Human	−20.3	10.5	3.2	2.6

Table 13.3. Stable isotope values from Etton causewayed enclosure.

RLAHA sample number	Site reference	Bone number	Species	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N ratio	Collagen (%)
ET1	E85 F1[106-107] 3	6882	Cattle	−21.9	5.1	3.2	7.4
ET2	E85 F1[109-112]ext 2	6977	Cattle	−21.9	5.2	3.3	1.1
ET4	E85 F1[140-145] 2	7516	Cattle	−22.0	5.6	3.2	9.7
ET8	E86 F1[177-9] 3	9943	Cattle	−22.0	7.0	3.2	6.5
ET12	E87 F1[239-0] 6	12397	Cattle	−21.7	4.6	3.3	5.7
ET20	E87 F1[228-0] 5	15490	Cattle	−21.3	6.3	3.3	6.5
ET21	E87 F1[207-0]	15726	Cattle	−22.2	6.4	3.2	14.4
ET24	E83 F1[16-0] 4	5201	Pig	−21.7	5.7	3.3	4.1
ET30	E87 F1[199-0] 5	11560	Pig	−21.4	5.1	3.5	2.5
ET31	E87 F1[238-234] 3	12496	Pig	−21.4	6.3	3.4	1.3
ET32	E87 F1[227-0] 4	13310	Pig	−21.1	6.1	3.2	1.8
ET39	E87 F1[207-00]	15724	Pig	−22.0	5.6	3.4	4.7
ET40	E87 F1[207-00]	15735	Pig	−21.8	5.0	3.3	5.7
ET43	E87 F1[207-00]	16299	Pig	−21.2	6.8	3.3	7.5
ET46	E82 F1[11-12] 3	644	Sheep	−22.2	6.6	3.3	13.4
ET47	E83 F1[16-0] 4	5221	Sheep	−21.1	5.2	3.3	17.0
ET61	E87 F1[207-00]	15733	Sheep	−21.8	4.7	3.3	17.4
ET62	E87 F1[207-00]	16300	Sheep	−21.1	5.5	3.4	3.0
ETH2	E82 F1[5-6] 2	453	Human	−20.9	10.7	3.3	13.3
ETH6	E82 F1[5-6] 2	4530	Human	−21.0	9.9	3.4	15.7

domestic species in both $\delta^{13}C$ and $\delta^{15}N$ ratios (Fig. 13.1). At each site (excluding Etton for the moment), sheep mean $\delta^{13}C$ values are slightly higher than cattle, while pig values are considerably higher than cattle or sheep. Sheep and cattle $\delta^{15}N$ values are similar, while pig mean $\delta^{15}N$ values are always higher than both cattle and sheep values, by 0.3–1.4‰. At Etton the difference between the species means is so small and the errors so large that they are not statistically distinguishable, but they follow the same patterns as at the other sites. Because collagen preservation was much more variable here the sample numbers are much lower, and inadequate to test for small differences in the means of rather variable populations. The differences between means may be small, often within the statistical error for any particular pair of means compared, but they are consistent. Multivariate analysis (*post hoc* multiple comparisons, Scheffé test, Ps<0.01) showed that mean $\delta^{13}C$ differs significantly between all three species, while cattle and sheep mean $\delta^{15}N$ values differ significantly from pig but not from each other.

The two values for red deer antler from Windmill Hill were not included in this analysis; they fall well within the cattle/sheep range for $\delta^{13}C$, and high within the cattle/sheep range for $\delta^{15}N$.

A few more measurements of animal isotope values from Windmill Hill were made during the dating programme (Table 13.6). They do not appear exceptional. The dog values are typical, with enriched $\delta^{15}N$ reflecting a more carnivorous diet than the other animals.

Variation between sites

Taking between-species variation into account, there is significant variation between sites in faunal $\delta^{15}N$ but not $\delta^{13}C$. Windmill Hill, with lowest mean $\delta^{15}N$, is significantly different from Chalk Hill, with the highest value (*post hoc* multiple comparisons, Scheffé test, P<0.05). This has obvious implications for interpretation of the human $\delta^{15}N$ values from these sites.

Humans

Results were obtained for eight humans from Windmill Hill, five from Chalk Hill and two from Etton. It is possible that the two from Etton are actually from the same skeleton (the question is not resolvable from the bag labelling and other records); the $\delta^{13}C$ values are very close though $\delta^{15}N$ differs by 0.8‰. No skeletal details were available for the humans from Chalk Hill. At Windmill Hill, all of the eight samples are described as adult (one 'young adult', WH26) or probably adult, and three are identified as male (WH20, WH22, WH27). The values from these are in no way exceptional. On such a limited sample, there is little isotopic evidence for dietary differentiation within the human population in relation to gender.

The single additional result from the dating programme (replicates OxA-14966, GrA-29711) for a human from Windmill Hill (Table 13.6) is considerably higher in $\delta^{15}N$ than those from the isotope study, and indeed than all the other humans measured during the dating programme; it

Table 13.4. Stable isotope values from Windmill Hill causewayed enclosure.

RLAHA sample number	Site reference	Bone number	Species	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N ratio	Collagen (%)
WH1	B228	4342	Red Deer	−22.5	5.7	3.2	3.6
WH2	B228	4331	Red Deer	−21.9	6.5	3.2	8.1
WH3	E525	50	Sheep	−21.9	3.7	3.2	6.3
WH4	E525	73	Sheep	−21.8	6.3	3.2	5.3
WH5	MD XII 4	699	Sheep	−21.7	6.9	3.3	4.2
WH6	ID XVII 4	706	Sheep	−20.9	8.3	3.3	5.1
WH7	MD IB 4	711	Sheep	−22.4	3.9	3.3	4.9
WH8	MD IX 3	715	Sheep	−22.4	6.2	3.2	3.5
WH10	MD IB 3	1088	Sheep	−22.6	4.0	3.3	4.1
WH11	MD VII 3	1172	Sheep	−21.8	4.8	3.3	3.5
WH12	MD VII 4	1173	Sheep	−21.7	4.4	3.3	2.9
WH13	E508	1818	Sheep	−22.1	4.3	3.2	3.7
WH14	E504	1868	Sheep	−22.3	4.9	3.3	4.6
WH15	E504	1870	Sheep	−23.0	4.6	3.3	3.5
WH16	E508	1919	Sheep	−21.6	4.7	3.2	5.1
WH17	B228	4337	Sheep	−22.2	4.2	3.2	4.7
WH18	B228	4370	Sheep	−22.3	4.6	3.3	5.0
WH19	B228	4421	Sheep	−22.9	4.8	3.2	2.0
WH20	MD II ?4	10	Human	−21.2	9.8	3.3	3.0
WH21	ID I/II 3	50	Human	−21.1	9.6	3.4	2.1
WH22	MD IB 4	112	Human	−21.3	8.5	3.3	4.4
WH23	ID XI 3	158	Human	−21.7	8.8	3.3	2.4
WH24	MD XB 3	183	Human	−21.7	9.3	3.3	3.5
WH25	MD XIA /2 l10	189	Human	−21.1	8.5	3.3	4.2
WH26	OD IIIC 6	220	Human	−21.4	8.7	3.3	2.8
WH27	Grave 707		Human	−21.2	9.0	3.3	1.4
WH28	E525	46	Cattle	−22.5	4.5	3.2	2.2
WH30	MD IX 3	271	Cattle	−22.7	5.1	3.3	1.7
WH31	ID VIII 3	273	Cattle	−21.9	4.7	3.2	1.6
WH32	MD XII 4	274	Cattle	−22.5	4.6	3.3	2.6
WH33	MD IB 5	277	Cattle	−22.5	5.0	3.3	3.3
WH34	MD VII 5	282	Cattle	−21.8	4.6	3.3	2.2
WH35	MD VII 4	283	Cattle	−22.0	5.1	3.3	4.3
WH36	MD VII 4	285	Cattle	−22.0	4.5	3.2	5.3
WH37	MD VI 5	908	Cattle	−21.8	4.6	3.2	4.7
WH38	MD IB 5	1307	Cattle	−22.5	5.9	3.3	4.4
WH39	MD IB 5	1313	Cattle	−22.8	5.2	3.3	2.7
WH40	MD VI 5	1491	Cattle	−22.3	4.9	3.2	6.8
WH41	E508	1800	Cattle	−22.3	4.5	3.3	2.7
WH42	E504	1854	Cattle	−22.3	5.2	3.2	4.3
WH43	B228	4374	Cattle	−23.0	5.9	3.2	5.4
WH44	B228	4382	Cattle	−22.1	4.6	3.2	4.2
WH45	E520	5872	Cattle	−22.2	4.3	3.2	2.7
WH46	E525	52	Pig	−20.6	6.1	3.2	8.8
WH47	E525	63	Pig	−20.8	6.1	3.2	4.4
WH48	E525	95	Pig	−21.1	5.9	3.2	3.8
WH49	ID VIII 3	739	Pig	−19.9	4.2	3.3	6.2
WH50	OD IB 6	740	Pig	−19.8	6.0	3.3	4.5
WH51	MD IX 4	743	Pig	−20.1	6.6	3.3	5.5

WH52	MD IB 4	744	Pig	−20.8	5.6	3.3	2.5
WH53	OD IV 5	745	Pig	−20.7	5.8	3.3	9.2
WH54	MD XII 4	755	Pig	−20.9	6.1	3.2	6.5
WH55	ID VIII 3	864	Pig	−20.9	6.4	3.3	5.5
WH56	D416	1416	Pig	−20.8	5.7	3.2	10.8
WH57	D416	1422	Pig	−20.6	8.5	3.2	5.6
WH58	D416	1741	Pig	−20.3	5.1	3.3	4.1
WH59	E510	1950	Pig	−20.1	6.0	3.2	5.5
WH60	E510	1964	Pig	−19.9	6.1	3.2	5.6
WH61	E510	1992	Pig	−20.8	6.4	3.3	5.1
WH62	B228	4339	Pig	−19.5	6.0	3.2	4.0

Table 13.5. Means and standard deviations of stable isotope values from each site.

Site	**Species**	**Mean $\delta^{13}C$ (‰)**	**SD**	**Mean $\delta^{15}N$ (‰)**	**SD**	**n**
Abingdon	Cattle	−22.1	0.5	5.8	0.5	19
	Pig	−20.9	0.4	6.1	0.4	17
	Sheep	−21.6	0.4	5.2	0.6	20
Chalk Hill	Cattle	−21.8	0.6	5.4	0.5	16
	Pig	−21.0	0.6	6.8	0.5	3
	Sheep	−21.5	0.5	6.1	0.6	13
	Human	−20.6	0.6	10.3	0.6	5
Etton	Cattle	−21.9	0.3	5.7	0.9	7
	Pig	−21.5	0.3	5.8	0.7	7
	Sheep	−21.6	0.6	5.5	0.8	4
	Human	−20.9	0.1	10.3	0.6	2
Windmill Hill	Cattle	−22.3	0.4	4.9	0.5	17
	Pig	−20.4	0.5	6.0	0.8	17
	Sheep	−22.1	0.5	5.0	1.2	16
	Red Deer	−22.2	0.4	6.1	0.6	2
	Human	−21.3	0.3	9.0	0.5	8

is from an individual 2–3 years-old, and probably reflects the higher trophic level of milk consumption during infancy. It is also probably more recent than the other individuals analysed from the site (*3490–3470 cal BC* (*9% probability*; Fig. 3.11: *WH29 B209*) or *3370–3330 cal BC* (*86% probability*)).

The humans from Chalk Hill and Windmill Hill differ significantly in both $\delta^{13}C$ and $\delta^{15}N$ (*t*-test, $P<0.05$, $P<0.01$ respectively, two-tailed). Both $\delta^{13}C$ and $\delta^{15}N$ are lower at Windmill Hill.

There are a few additional comparable results from the dating programme for humans from other causewayed enclosures, one each from Hill Croft Field and Offham Hill, two from Maiden Castle and three from Whitehawk (Table 13.6). While these are too few to look for systematic differences, Windmill Hill seems consistently most depleted in both $\delta^{13}C$ and $\delta^{15}N$; unfortunately there are no comparable faunal data from the other sites.

13.6 Discussion

Fauna

Within-species variation. The ranges of variation in the faunal data are similar to those found at other sites with large datasets. Many factors may contribute to this (see Introduction). There was no consistent difference between chalkland and other sites.

There were some outlying values (>2 standard deviations from the mean). These are consistent between replicates, identifications appear correct, as far as could be told the bones were from adult animals, and there was no apparent pathology. Occasional outlying values have been noted at other sites such as Ascott-under-Wychwood (R. Hedges *et al*. 2007b), and Wharram Percy (Müldner and Richards 2005). They may represent animals that for some reason were fed or treated differently from other stock, though apparently deposited similarly to other bone at the sites.

Table 13.6. Additional stable isotope values from the dating programme. Data from 'excluded' dates have been omitted.

Site	Sample reference	Material	Reference	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	Notes
Hill Croft Field	HC06 30/B	Human bone	OxA-15867	–19.5	8.1	
Maiden Castle	401 14577/A	Human bone	OxA-14832	–20.2	10.9	3–4 years
	401 2026	Human bone	OxA-14837	–20.6	9.2	3–5 years
Offham Hill	Burial 1. Barbican House Museum, Lewes 77.23	Human bone	GrA-27322	–20.9	10.5	20–25 years, male
Whitehawk	Brighton Museum R3162/169/N (1)	Red deer antler	GrA-26962	–23.8	5.7	
	Brighton Museum R3688/138/B	Cattle bone	GrA-26972	–21.8	5.5	
	Skeleton I. Brighton Museum R3688/128/S	Human bone	GrA-26971	–20.7	10.0	25–30 years, female
	Skeleton IIa. Brighton Museum R3688/129/T	Human bone	OxA-14063*	–20.6	9.9	20–25 years, female
	Skeleton IIa. Brighton Museum R3688/129/T	Human bone	GrA-26977*	–21.1	9.7	
	Skeleton III. Brighton Museum R 4100/139 221788/U	Human bone	OxA-14061	–20.3	10.0	Middle-aged male
Windmill Hill	WH26 B22.a	Dog bone	GrA-25558	–20.9	9.4	
	WH26 B22.c	Sheep bone	OxA-13715	–21.0	5.2	
	WH28 B106	Dog bone	OxA-13505	–20.4	7.3	
	WH28 B114	Red Deer antler	GrA-25554	–21.8	4.6	
	WH28 B369	Cattle bone	GrA-25555	–23.8	5.0	
	WH28 B370	Cattle bone	GrA-25545	–22.8	4.2	
	WH28 B372	Cattle bone	OxA-13679	–22.0	5.5	
	WH28 B374	Cattle bone	GrA-25559	–22.9	5.3	
	WH28 B671	Cattle bone	OxA-13501	–21.3	4.7	
	WH29 B209	Human bone	OxA-14966*	–21.1	11.9	2–3 years
	WH29 B209	Human bone	GrA-29711*	–21.7	11.8	
	WH88 12281 (B70)	Cattle bone	GrA-25707	–23.1	5.3	
	WH88 12301 (B54)	Cattle bone	OxA-13713	–22.1	5.3	
	WH88 1687 (B5338)	Large mammal bone	GrA-25546	–22.2	4.1	cf. cattle
	WH88 1688 (B5330)	Large mammal bone	OxA-13504	–21.3	4.7	cf. cattle
	WH88 1712 (B18)	Cattle bone	OxA-13503	–22.2	4.8	
	WH88 23207 (B4600)	Cattle bone	GrA-25553	–22.5	4.4	

	WH88 4225 (B1441)	Medium mammal bone	GrA-25556	−23.2	6.1	cf. sheep or pig
	WH88 4255 (B1458)	Medium mammal bone	OxA-13714	−22.0	6.4	cf. sheep or pig
	WH88 4330 (B1743)	Cattle bone	GrA-25706	−22.5	4.8	
	WH88 6419 (B1344)	Cattle bone	GrA-25560	−22.1	5.4	

* Immediately preceding/following measurement made at Oxford (OxA) or Groningen (GrA) on separate sample of same bone

Table 13.7. Correlations between human and faunal isotope values from Neolithic sites.

$\delta^{13}C$	**Human**	**Cattle**	**Pig**	**Sheep**
Human	1			
Cattle	0.62^2	1		
Pig	−0.11	0.11	1	
Sheep	0.21	0.66^2	0.12	1
$\delta^{15}N$				
Human	1			
Cattle	0.75^1	1		
Pig	0.48	0.60^2	1	
Sheep	0.72^2	0.59^2	0.89**	1
n	6	7	7	7

** $P<0.01$; $^1 0.10>P>0.05$; $^2 0.20>P>0.10$

Differences between species. The pattern of faunal values at the causewayed enclosures is consistent with that seen at other Neolithic sites for which there are enough data, e.g. the long barrows at Ascott-under-Wychwood (R. Hedges *et al*. 2007b) and Hazleton (R. Hedges *et al*. 2008), and Hambledon Hill (M. Richards 2000). Mean values for sheep and cattle are similar though cattle always have slightly more depleted values for $\delta^{13}C$ than sheep, and may have higher or lower $\delta^{15}N$ values, while pigs have clearly less depleted values for $\delta^{13}C$ and slightly enriched values for $\delta^{15}N$.

One obvious explanation might be that this reflects the different digestive physiologies of these animals, rather than isotopic differences in the diet; sheep and cattle are ruminants, with the foregut specialised to use bacterial fermentation to break down cellulose, while pigs are not. In support of this, red deer, also ruminants, group with sheep and cattle where data are available, while at Ascott-under-Wychwood isotope values from pigs identified as wild were not distinguishable from those of domestic pigs. It is not clear exactly why pig $\delta^{13}C$ values should be less depleted, but some physiological explanation might be possible. However, at later sites such as Thorpe Lea Nurseries and Yarnton (R. E. M. Hedges and J. Hamilton, unpublished work), Broxmouth, Trevelgue Head, Wetwang and Garton Slack, and Winnall Down (Jay and Richards 2006; 2007), and Roman York (Müldner and Richards 2007), pig values show an equally consistent but quite different relationship, with similar $\delta^{13}C$ values to sheep/cattle and higher $\delta^{15}N$s. It is unlikely that basic digestive physiology had changed over that time, but pig management may well have done, one probable explanation being a shift to feeding on human food waste giving pigs effectively a higher trophic level. In this case the enriched $\delta^{13}C$ values of Neolithic pigs would reflect a dietary difference. The slightly enriched $\delta^{15}N$ values in the Neolithic could plausibly be explained as due to a somewhat more omnivorous diet than sheep/cattle, or as a difference between ruminants and non-ruminants, but it is hard to explain the $\delta^{13}C$ values. One possibility to

consider is the consumption of mycorrhizal and saprophytic fungi, which can have enriched $\delta^{13}C$ values compared to foliage (Hart *et al*. 2006; Trudell *et al*. 2004), reflecting more extensive use of wildwood resources by pigs in the Neolithic than in the Iron Age. This is not implausible, though it is generally assumed that Iron Age (and later) pigs also made considerable use of woodland resources (e.g. Grigson 1982b). Perhaps later woodlands were more intensively managed, with much less dead wood supporting saprophytic fungi with enriched $\delta^{13}C$ values (Hamilton *et al*. 2009).

The slight difference in mean $\delta^{13}C$ values between sheep and cattle seems to be consistent wherever prehistoric datasets are large enough to detect it. It is tempting to attribute it to a canopy effect, with sheep feeding in more open environments than cattle, by analogy with the difference between domestic cattle and aurochs seen at Ascott (Hedges *et al*. 2007b), and more generally in southern Scandinavia (Noe-Nygaard *et al*. 2005) and Britain (Lynch *et al*. 2008). However, a study of modern red deer populations feeding in open and forested environments (Stevens *et al*. 2006) was unable to demonstrate a canopy effect. If it does reflect a dietary difference, it might be to do with use of wetland resources rather than woodland. The ubiquity of the pattern (so far) might also suggest a metabolic rather than an environmental explanation, though it is not obvious what this might be.

Variation between causewayed enclosures. The patterns of faunal isotope ratios differ among the four sites, though as noted above, by rather small amounts compared with overall variability, and few of the differences are statistically significant. Many factors may contribute to this, and with only four sites it is unlikely that these can be distinguished. There is no clear pattern for this small set of sites in relation to obvious contrasts such as chalk (Windmill Hill, Chalk Hill) versus gravel (Abingdon) or wetter sites (Etton), species proportions at the sites, or the extent of forest clearance locally (as far as can be deduced from other environmental evidence).

Humans

The mean $\delta^{13}C$ and $\delta^{15}N$ values for humans from Chalk Hill are significantly less depleted than those from Windmill Hill. However, the mean values for the fauna also differ, with those from Chalk Hill also consistently less depleted (except pig $\delta^{13}C$, based on only 3 values at Chalk Hill). This will be discussed further below.

Comparing causewayed enclosures with other Early Neolithic sites

There are comparable data for humans and animals from the Cotswold long barrows at Ascott-under-Wychwood (R. Hedges *et al*. 2007b) and Hazleton (R. Hedges *et al*. 2008), and from the long barrow and enclosures at Hambledon (M. Richards 2000).

As discussed above, the pattern of values for cattle, sheep and pig from causewayed enclosures is consistent with that from the other sites. With all seven sites included, multivariate analysis showed that mean $\delta^{13}C$ differs significantly between all three species, while cattle and sheep mean $\delta^{15}N$ values differ significantly from pig but not from each other (*post hoc* multiple comparisons, Scheffé test, *P*s<0.01), just as for causewayed enclosures alone. Including only domestic fauna, and analysing the two phases at Ascott-under-Wychwood separately, both $\delta^{13}C$ and $\delta^{15}N$ varied significantly between sites (*post hoc* multiple comparisons, Scheffé test, *P*s<0.05, <0.01, respectively). For $\delta^{13}C$ this mainly reflected higher (less depleted) values at Hambledon, while for $\delta^{15}N$ it was the low values from Hazleton that stood out. Again, with this larger set of sites, there were no patterns that could clearly be related to environmental contrasts such as chalk or limestone geology versus low-lying, wetter sites, or to the site type.

Comparing humans and animals

The difference in $\delta^{15}N$ values between human and herbivore populations reflects their relative trophic level (ignoring fish for the moment). To estimate the difference, it seems reasonable to subtract the mean animal $\delta^{15}N$ value from the mean human value at a site, but there are some uncertainties in arriving at these figures. It is reasonable to omit juvenile humans and animals with high $\delta^{15}N$ values that are probably due to suckling (but see Jay and Richards 2006). One could take the mean of all herbivore values, but as we have shown that animal $\delta^{15}N$ values can differ between herbivore species, we would need to know how the different species are represented in human diets. We could weight the faunal means by relative abundance, but there are several alternative ways to express that, with differing results. We do not know how closely the relative quantities of bone deposited at a site, let alone the relative numbers of different species actually sampled, represent the diet of the humans at that site. Since cattle are much larger than sheep and pigs, it is likely that they supply the majority of meat and milk even at sites where they are relatively less represented, so one approach would be to look at the human-cattle difference ($\Delta^{15}N_{\text{human-cattle}}$). This is 4.9, 4.6 and 4.1‰ at Chalk Hill, Etton, and Windmill Hill respectively. For comparison, it is 4.5, 4.2 and 4.2 at Ascott-under-Wychwood (barrow construction phase), Hambledon and Hazleton, respectively. These are not significantly different between causewayed enclosures and other types of site (*t*-test), and are towards the high end of the expected range for humans eating meat and dairy products.

Is the difference between the high and low end of the range – in this case, between Chalk Hill and Windmill Hill – likely to represent a real difference in diet? Taken at face value, the figures would imply that >95% and >80%, respectively, of protein in collagen was from animal sources (taking $\Delta^{15}N_{\text{collagen-diet}}$ as 5‰), or a little less if pig made a significant contribution, but however calculated this remains surprisingly high. The issues raised have recently

been thoroughly discussed (Hedges and Reynard 2007). The standard deviations of the estimate of $\Delta^{15}N_{human\text{-}cattle}$ are ±0.8‰ (Chalk Hill) and ±0.7‰ (Windmill Hill), so the difference is not statistically significant; at this level of error the difference would need to be about twice as great to be significant at α=0.05, though with larger samples of humans the error should be less, allowing finer discriminations. In any case, the causewayed enclosure results confirm the previous isotopic evidence from the Neolithic that a high proportion of human collagen protein came from animal sources. There is no evidence for the use of marine resources, either archaeologically or in the isotopes, though a small amount of freshwater fish in the diet cannot be ruled out on isotopic grounds.

If the standard interpretation of the human-faunal difference (Δ) holds (but see Hedges and Reynard 2007), at least 80% of collagen protein, implying about 50% of energy, in the diet comes from animal sources. There is little evidence that wild animals were important in the diet, while the relative importance of cultivated cereal versus gathered foods such as hazelnuts is still controversial (G. Jones 2000; Robinson 2000c; Rowley-Conwy 2004; Bogaard and Jones 2007). It is difficult to construct model human diets with very high values of Δ that are sustainable both nutritionally and agronomically, but including varying amounts of nuts as well as cereals, and particularly including dairy products, gives a more plausible range of possibilities. Some contemporary pastoralists may provide analogues of this kind of diet (see Hedges and Reynard 2007), though conditions may have been very different in southern Britain in the fourth millennium cal BC. A pastoralist economy need not imply reliance on wild plant foods as opposed to cultivated cereals, or any particular pattern of settlement mobility or sedentism; evidence from settlement sites, rather than sites of assembly such as causewayed enclosures, will be crucial in selecting among the various possibilities.

As noted above, both fauna and humans are more depleted in ^{13}C and ^{15}N at Windmill Hill than at the other sites. Are site means of faunal and human isotope ratios correlated when compared over all seven sites? Humans and cattle, and sheep and cattle (but not sheep and humans), show correlations of >0.6 in $\delta^{13}C$, though these are not significant (0.20>P>0.10) (Table 13.7). Correlations between $\delta^{15}N$ values are higher: >0.7 between humans and cattle or sheep (P= 0.09, 0.11 respectively), and 0.89 (P<0.01) between sheep and pig. Results from only a few more sites could confirm or falsify these apparent patterns, and if they turn out to be consistent would have important implications for understanding human palaeodiet. It would suggest that there is a real connection between animal and human values from the same site and that this is a valid scale of comparison; that measuring humans at a site without faunal measurements could be seriously misleading; and that the human-bovid dietary relationship is apparently similar over the range of sites studied.

13.7 Conclusions

The isotopic results for humans and animals from these four causewayed enclosures fit the emerging pattern for the earlier Neolithic in southern Britain. The $\delta^{13}C$ values of cattle, sheep and pig differ consistently, and pigs in particular show somewhat enriched $\delta^{13}C$ values relative to cattle and sheep, a pattern that is unusual at later sites. We suggest that this may be related to the use of wildwood resources. Pigs also have slightly enriched $\delta^{15}N$ values relative to cattle and sheep, but not to the extent seen at later sites, suggesting a different management regime in the earlier Neolithic. Mean faunal values can differ significantly between sites, and this needs to be taken into account when comparing human values.

The human-faunal difference ($\Delta^{15}N_{human\text{-}cattle}$) is over 4‰ at all the causewayed enclosures, in agreement with results from other earlier Neolithic sites. On the current interpretation, this implies a high proportion of animal protein (meat or dairy) in the diet. This could be interpreted as a pastoralist economy, but does not necessarily imply high reliance by people on wild plant foods as opposed to cultivated cereals, or any particular pattern of mobility.

Large comparable faunal samples are important when interpreting human isotopic values, and can also provide information on human interactions with the environment via agricultural systems, at geographical scales from site to landscape, and over archaeological time.

Acknowledgements

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14 Neolithic narratives: British and Irish enclosures in their timescapes

Alex Bayliss, Frances Healy, Alasdair Whittle and Gabriel Cooney

14.1 Weaving narrative threads

If a 'landscape is time materializing' (Bender 2002, S103), a timescape is a dynamic land in which change materialises. It is a place accessed through the bare threads of chronology weaving together, crossing and connecting as warp and weft at particular points in space-time – 'events' in the parlance of relativist physics. But these 'events' and our chronological threads are not points and lines in Euclidean space (or even in some more curvaceous space-time metric). Both have areas, known to us only through the probability density functions of our posterior beliefs (Chapter 2.3), which reflect the varying resolution of our chronologies (Chapter 1.1).

We have already spun threads of chronology for selected sites in different regions of southern Britain. In some of those regions, and in Ireland, we have gone further and started to weave those threads into a cloth for the wider early Neolithic. In this chapter we will weave further sections of this material; the pattern of threads will be established by the sequences derived from our chronologies, the spacing of the threads will be set by the gaps and intervals between events in these sequences, and the ply of our yarns will be determined by the chronological resolution available to us. The resultant textile will, perforce, be rather uneven, but will reflect the structure of past events.

So, as we trace our chronological threads across the fabric of the insular early Neolithic, we are following not lines (Ingold 2007a, 84–90) but yarns of variable ply. Neighbouring threads may be near or far, the weave may be obscured by the thickness of our yarn, but, if we inhabit our thread, moving with space-time as a wayfarer (Mithen 2003), an event occurs, not as an unconnected point to be located in relation to our observer's position in the reference frame of our present, but as a happening in its context, deriving from past events and paving the way for future ones. Our observation can hope to come to not just a sense of this particular place at this particular time, but to reveal the history of the place as it moves forward through time.

This is surely what Paul Ricoeur meant when he wanted, in large part following on from Heidegger, to get away from time as a 'linear succession of instants', to explore the human experience of what he calls 'within-time-ness', and to investigate what he calls 'historicality', an emphasis on the weight of the past, and his view of temporality which he calls 'the plural unity of future, past and present' (Ricoeur 1980, 170–1). What is central for our purposes here is Ricoeur's insistence on the importance of narrative (1980; 1984). Narrative involves plot, 'the intelligible whole that governs a succession of events in any story' (Ricoeur 1980, 171). As his own account unfolds, it is clear that succession is important, as 'the episodic dimension' of narrative, alongside its 'configurational dimension, according to which the plot construes significant wholes out of scattered events' (Ricoeur 1980, 178); 'the humblest narrative is always more than a chronological series of events', since it elicits 'a configuration from a succession' (Ricoeur 1980, 178). In these circumstances, it is easy to disagree with his apparent dismissal of sequence, and what he calls, right from the beginning, the 'illusion of chronology' (Ricoeur 1980, 169). Chronology provides the succession which is required to elicit configuration. It relates scattered events and gives us access to the plot. It is not narrative, but a means to narrative.

Much, therefore, is at stake. We believe that we have to get succession right (and that the discipline has the means now to do this better), but that succession on its own is not enough; in narrative we can trace change, connection and causality. So far in this volume we have sought to exploit the now routine availability of Bayesian modelling to provide quantified, explicit, probabilistic date estimates for, first, a significant sample of early Neolithic enclosures in southern Britain and Ireland, and secondly, a variable sample of other forms of early Neolithic activity in those areas. We have proceeded region by region, and now it is time to bring the many models together, to provide generational narratives for the date, duration and character of the enclosures on the one hand and of other forms of early Neolithic activity on the other. In this way, as already seen in the regional chapters, we can provide estimates for the

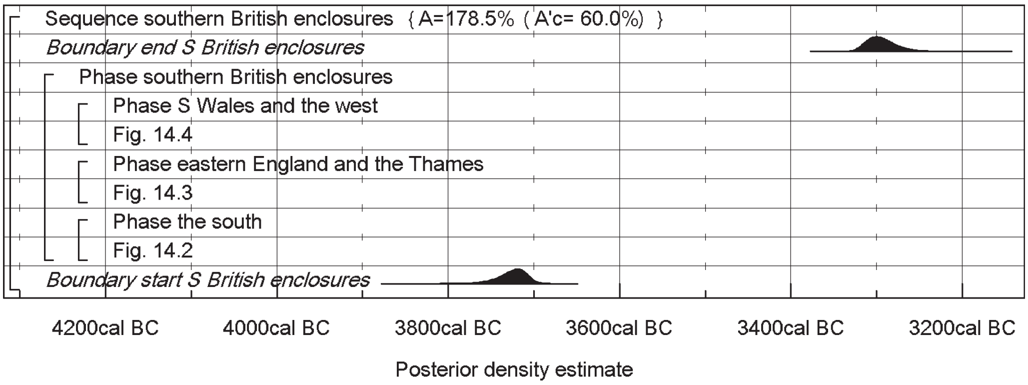


Fig. 14.1. Overall structure of the chronological model for the currency of causewayed and related enclosures in southern Britain. Each distribution represents the relative probability that an event occurred at a particular time. The distributions for the start and end of the use of each enclosure have been taken from the site models described in detail in Chapters 3–11 (and listed in the captions to Figs 14.2–4), and are shown in outline. Other distributions are based on the chronological model defined here, and shown in black. For example, the distribution 'start S British enclosures' is the estimated date when the first enclosure was constructed in this area. Distributions followed by a question mark are not included in the model for reasons explained in the text. The component sections of the model are shown in Figs 14.2–4. The large square brackets down the left-hand side of Figs 14.1–4, along with the OxCal keywords, define the overall model exactly.

place of enclosures within the history of the first centuries of the southern British and Irish Neolithic, and we can begin to use this control over the lapse of time to highlight some of the major issues concerning the use and character of these enclosures. We begin with southern Britain, starting with the enclosures themselves, and then comparing our date estimates for them with those separately derived for the start of the Neolithic. We then consider the place of some elements of early Neolithic things and practices individually. After this, we come back to Ireland and the Isle of Man, and briefly discuss some data from Scotland. There are many gaps in our coverage, and this chapter has to be regarded as a preliminary exercise in the wider task of constructing reliable chronologies and exploring narratives for the early Neolithic of Britain and Ireland as a whole. We will go on to discuss the many implications raised by our narratives in the final chapter.

14.2 Chronologies for enclosures in southern Britain

The currency of causewayed enclosures

A model for the construction and use of causewayed and related enclosures in southern Britain is shown in Figs 14.1–4. This has been constructed by taking the estimated dates for the start and, where appropriate, the end of the primary use of each site from the site models described in detail in Chapters 3–11. This constitutes the second twist of our hermeneutic spiral (Fig. 2.5), as the posterior density estimates provided by our site-based models now form the standardised likelihoods of this new model. The detail of the treatment of individual dates (for example why a particular measurement is treated as a *terminus post quem* or excluded) is given in the regional chapters. The prior information in this second round of modelling is now that enclosures were constructed and used continuously and relatively constantly over the period of their initial currency. We explore this assumption further below.

This model suggests that the first causewayed and related enclosure in southern Britain was constructed in *3765–3695 cal BC* (*95% probability*; Fig. 14.1: *start S British enclosures*), probably in *3740–3705 cal BC* (*68% probability*). It also suggests that the last enclosure in southern Britain went out of primary use in *3330–3255 cal BC* (*95% probability*; Fig. 14.1: *end S British enclosures*), probably in *3315–3280 cal BC* (*68% probability*). As discussed in the regional chapters, especially in relation to Windmill Hill (Chapter 3), endings are harder to define than beginnings.

The model shown in Figs 14.1–4 has good overall agreement ($A_{overall}$=178.5%). The endings of two sites, however, have been excluded from it. Although a model which includes all end dates has good overall agreement ($A_{overall}$=127.2%), in this interpretation *end Banc Du* has poor individual agreement (A=22.6%). It can be seen that the disuse of this enclosure falls more than half a millennium later than all the others considered in this volume (Fig. 14.4). This seems to relate to the late recut at this site (Chapter 11). When *end Banc Du* is excluded from the model, it again has good overall agreement ($A_{overall}$=135.9%), although now *end Haddenham* has extremely poor individual agreement (A=4.7%). For this reason, this distribution has also been excluded from the model (Fig. 14.3). The difficulties of dating Haddenham and the uncertain formation processes for the shell marl platform above the initial silts of its ditch, which provided the latest dates, have been discussed in Chapter 6.

The establishment of enclosures

Figure 14.5 investigates the period during which enclosures were constructed in southern Britain. In this case, a continuous and relatively constant period of enclosure

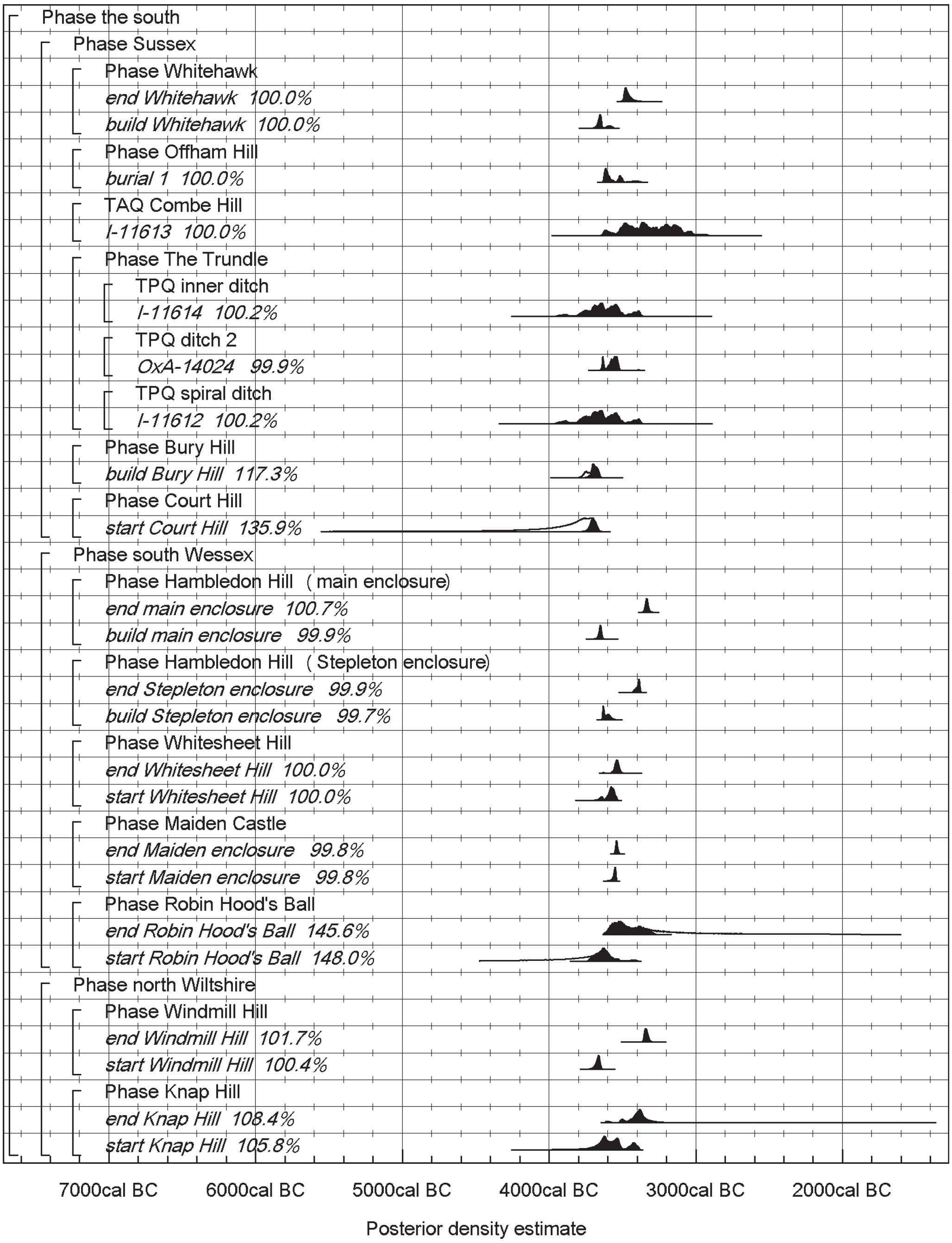


Fig. 14.2. Probability distributions of dates for causewayed and related enclosures from the south. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Figs 3.8–11 (Windmill Hill), Fig. 3.25 (Knap Hill), Fig. 4.51 (Robin Hood's Ball), Figs 4.41–5 (Maiden Castle), Fig. 4.26 (Whitesheet Hill), Figs 4.7–13 (Hambledon Hill), Fig. 5.28 (Court Hill), Fig. 5.25 (Bury Hill), Fig. 5.14 (Offham Hill), and Figs 5.5–9 (Whitehawk). Dates from The Trundle and Combe Hill have been calibrated (Stuiver and Reimer 1993). The overall structure of this model is shown in Fig. 14.1, and its other components in Figs 14.3–4.

construction is incorporated in the model along with the estimated start dates for each site provided by the site-based models defined in Chapters 3–11. This model suggests that new enclosures were established from *3750–3685 cal BC* (*95% probability*; Fig. 14.5: *start new S British enclosures*), probably from *3730–3700 cal BC* (*68% probability*). The last enclosure on virgin ground was constructed in *3595–3510 cal BC* (*95% probability*; Fig. 14.5: *end new S British enclosures)*, probably in *3565–3525 cal BC* (*68% probability*). New enclosures were built for a period of *105–225 years* (*95% probability*; Fig. 14.6: *initiation S British enclosures*), probably for a period of *140–195 years* (*68% probability*).

A model which estimates the time when the circuits of the causewayed and related enclosures in southern Britain were dug is shown in Figs 14.7–10. This incorporates estimates for the dates of construction for all the circuits considered in Chapters 3–11. For Hambledon Hill the cross-

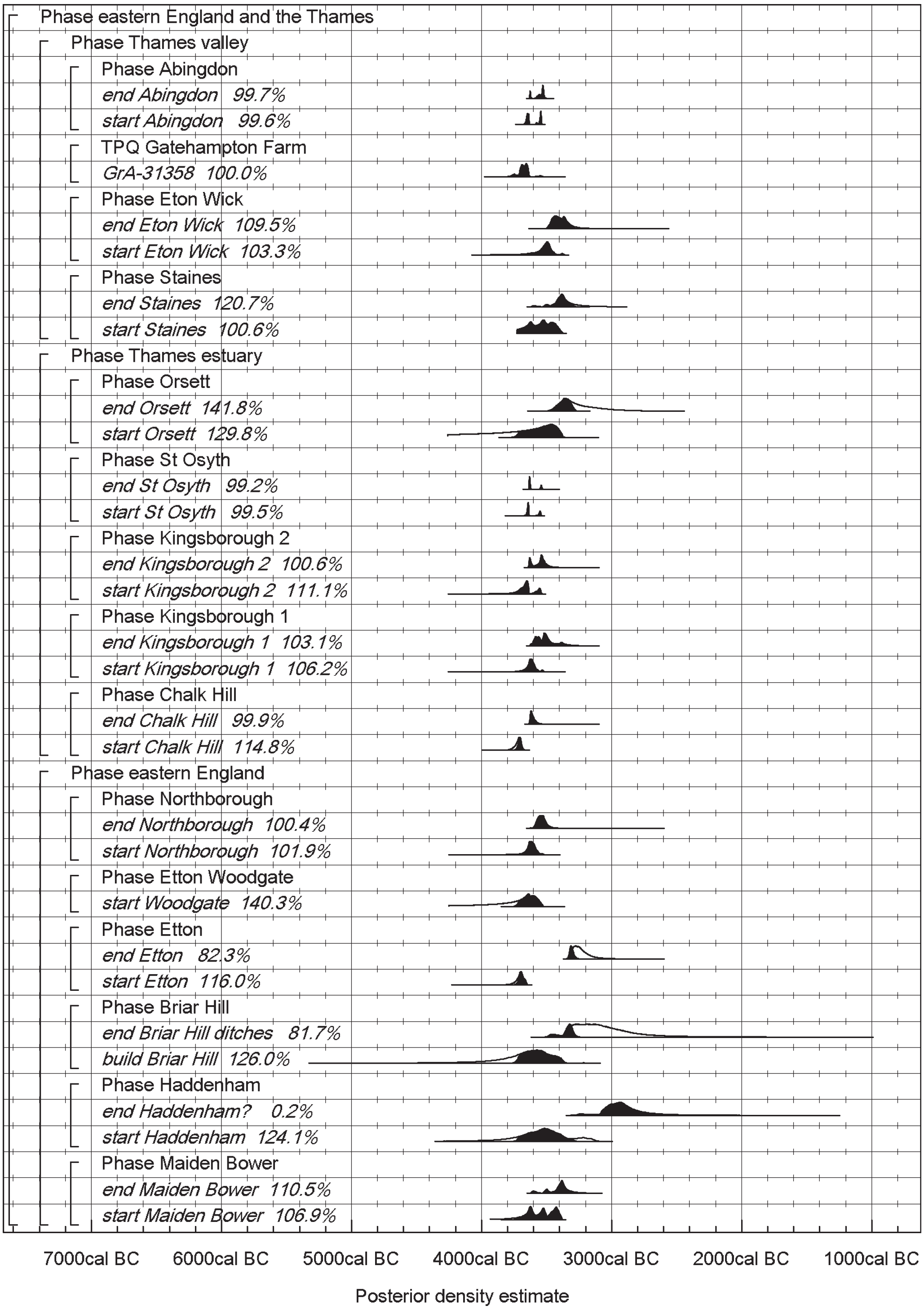


Fig. 14.3. Probability distributions of dates for causewayed and related enclosures from eastern England and the Thames valley. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Fig. 6.39 (Northborough), Fig. 6.36 (Etton Woodgate), Fig. 6.33 (Etton), Fig. 6.23 (Briar Hill), Fig. 6.11 (Haddenham), Fig. 6.4 (Maiden Bower), Fig. 7.21 (Chalk Hill), Figs 7.15 and 7.17 (Kingsborough 1 and 2), Fig. 7.10 (Orsett), Fig. 7.6 (St Osyth), Figs 8.18–8.21 (Abingdon), Fig. 8.5 (Eton Wick), and Fig. 8.3 (Staines). The date from Gatehampton Farm has been calibrated (Stuiver and Reimer 1993). The overall structure of this model is shown in Fig. 14.1, and its other components in Figs 14.2 and 14.4.

dykes are treated here as outer circuits of the enclosure; the outworks are not included in the model. This model is therefore different to that defined in Fig. 14.5, because now we are investigating whether further elaboration of existing sites continued once new monuments had ceased to be founded. Again, a continuous and relatively constant period of earthwork construction is assumed. *UB-4267*, from the outer east cross-dyke on Hambledon Hill (Chapter 4), has poor individual agreement if included in the model (A=4.7%), although the model as a whole has good overall

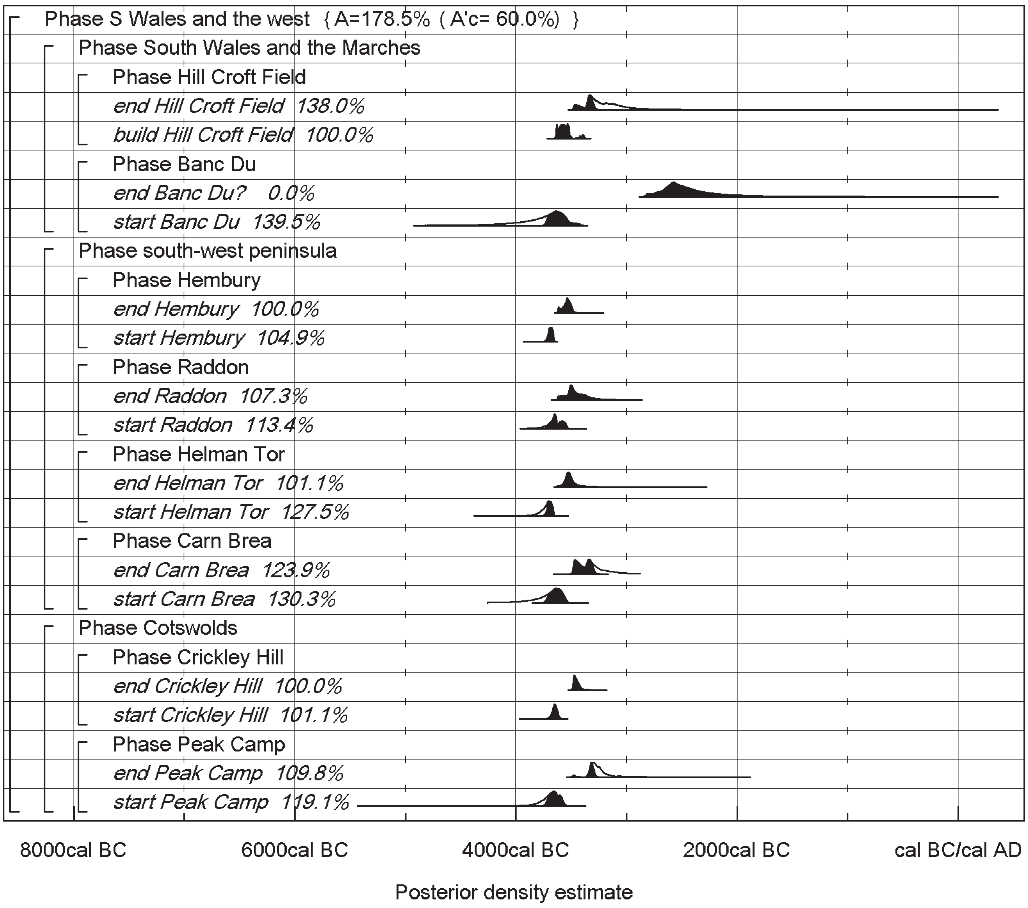


Fig. 14.4. Probability distributions of dates for causewayed and related enclosures from south Wales and the west. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Fig. 9.19 (Peak Camp), Figs 9.7–10 (Crickley Hill), Fig. 10.25 (Carn Brea), Fig. 10.22 (Helman Tor), Fig. 10.16 (Raddon), Figs 10.9–12 (Hembury), Fig. 11.15 (Church Lawford and Lower Luggy), Fig. 11.8 (Banc Du) and Fig. 11.3 (Hill Croft Field). The overall structure of this model is shown in Fig. 14.1, and its other components in Figs 14.2–3.

agreement in this reading ($A_{overall}$=77.7%). This date estimate may relate to a remodelling of the ditch segment in question (Chapter 4) and so may constitute continued use rather than fresh construction. If this distribution is excluded from the model, however, it then has poor overall agreement ($A_{overall}$=38.3%). Consideration of the individual indices of agreement clearly shows that it is the later circuits which have poor agreement (such as *build Orsett inner*, A=7.5%; *build Orsett entrance*, A=9.3%; *build Eton Wick inner*, A=29.4%). The construction dates for these three earthworks have therefore also been excluded from this model. It seems that the phase of construction of the circuits of southern British enclosures is not distributed uniformly, but rather that a few circuits continued to be built after an intensive period of circuit construction. In order to estimate the time when the first circuit was constructed, it is necessary, however, to define an ending for the period when circuits were dug. We have chosen to exclude the estimates for the construction of the dated circuits at Orsett and Eton Wick, and for the outer east cross-dyke at Hambledon Hill, from the model shown in Figs 14.7–10, which raises the overall agreement to an acceptable level ($A_{overall}$=84.0%). In effect, this approach estimates the end of the hey-day of circuit construction, rather than the end of all circuit construction. In this scenario, enclosure construction may have tailed off rather than come to a sudden halt. This approach is admittedly somewhat arbitrary, as we could, for example, have chosen to remove other potentially late constructions (such as Fig. 4.9: *build Knap Hill*; *build inner south cross-dyke*). In practice, however, these choices do not affect the outputs of the model importantly.[1] Although Eton Wick and Orsett are in the Thames valley and estuary respectively, it should be noted that other candidates for late circuits are to be found elsewhere.

This model suggests that the intensive construction of causewayed and related enclosure circuits in southern Britain began in *3715–3670 cal BC* (*95% probability*; Fig. 14.7: *intensify building circuits*), probably in *3705–3680 cal BC* (*68% probability*). The model suggests that this period of intensive circuit construction ended in *3555–3515 cal BC* (*95% probability*; Fig. 14.7: *end building new circuits*), probably in *the 3540s or 3530s cal BC* (*68% probability*). The hey-day of circuit construction spanned a period of *120–190 years* (*95% probability*; Fig. 14.11: *dig circuits*), probably of *135–170 years* (*68% probability*).

Figure 14.12 shows the estimated dates relating to

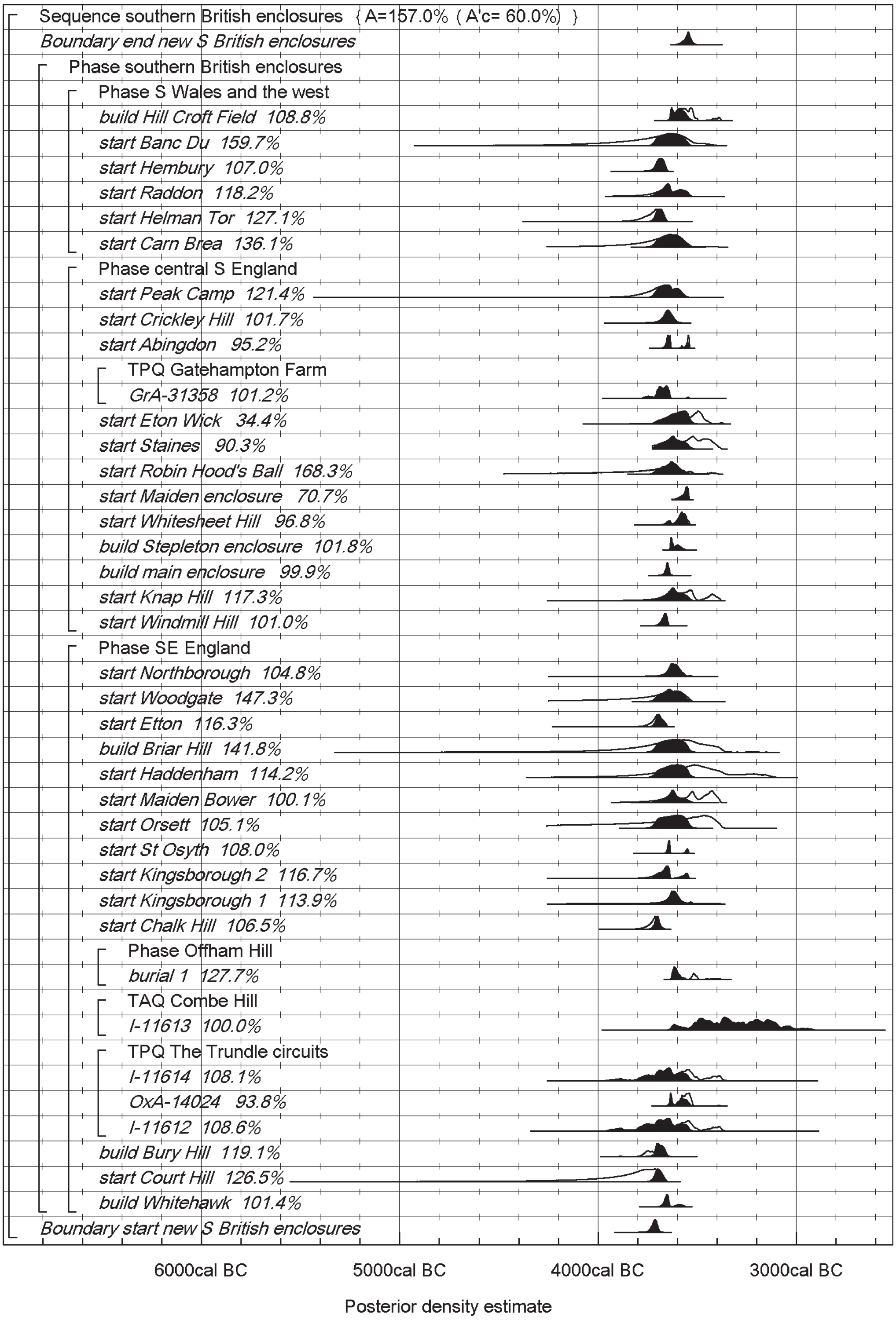


Fig. 14.5. Probability distributions of dates for the start of causewayed and related enclosures in southern Britain. Distributions have been taken from the models defined in Chapters 3–11, as detailed in the captions to Figs 14.2–4. The format is identical to that for Fig. 14.1. The large square brackets down the left-hand side, along with the OxCal keywords, define the overall model exactly.

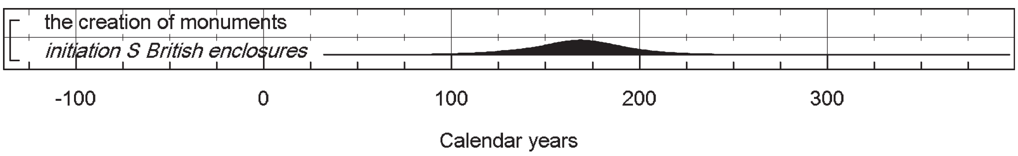


Fig. 14.6. Probability distribution of the number of years during which new causewayed and related enclosures were established in southern Britain, derived from the model defined in Fig. 14.5.

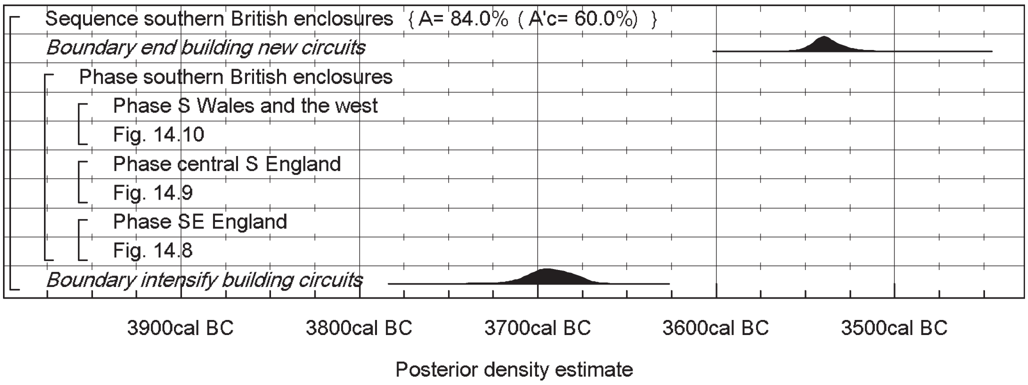


Fig. 14.7. Overall structure of the chronological model for the main period during which the circuits of the causewayed and related enclosures in southern Britain were constructed. Distributions have been taken from the models defined in Chapters 3–11, as detailed in the captions to Figs 14.2–4. The format is identical to that for Fig. 14.1. The large square brackets down the left-hand side of Figs 14.7–10, along with the OxCal keywords, define the overall model exactly.

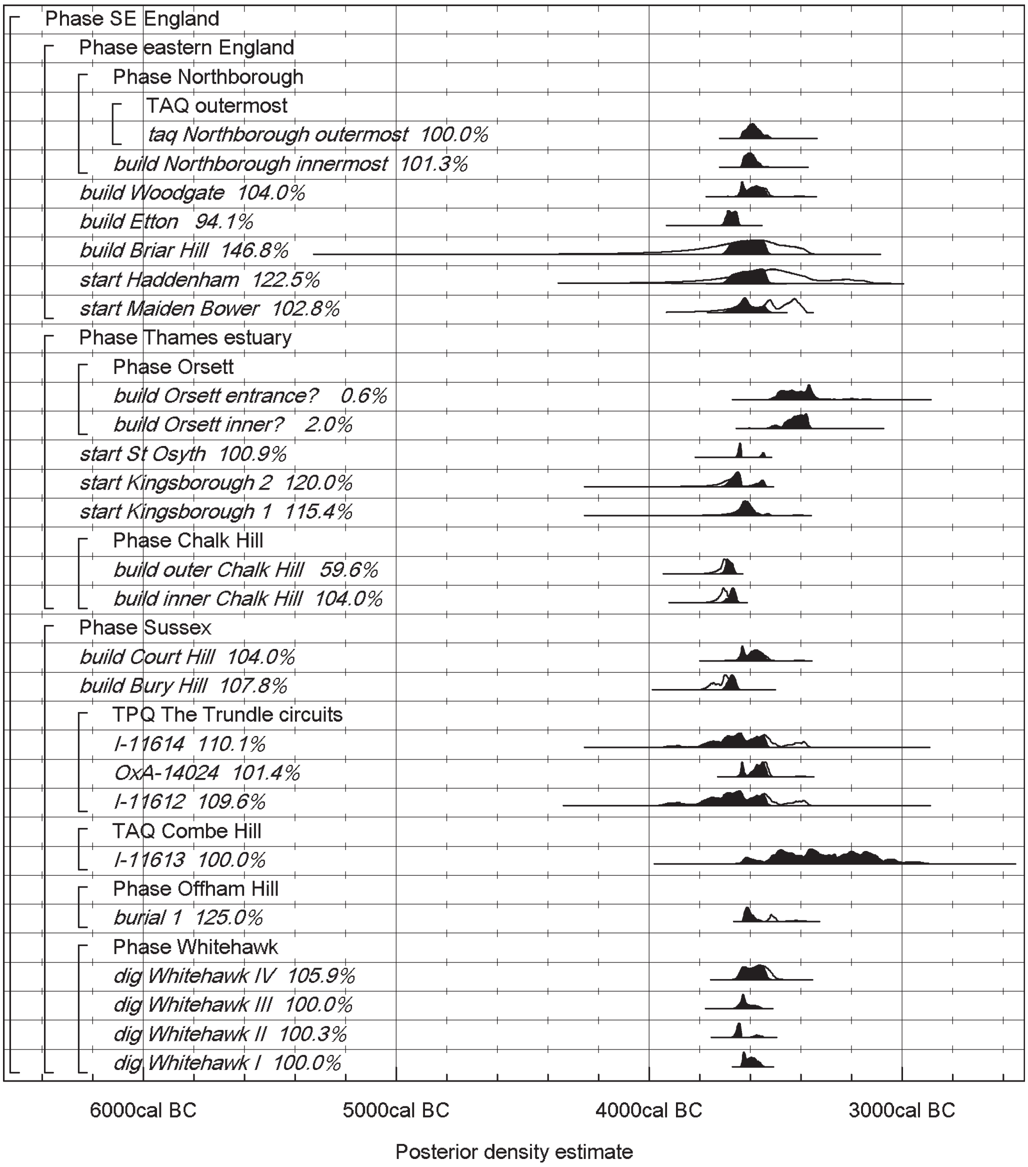


Fig. 14.8. Probability distributions of construction dates for circuits of causewayed and related enclosures from south-east England. The format is identical to that for Fig. 14.1. The overall structure of this model is shown in Fig. 14.7, and its other components in Figs 14.9–10.

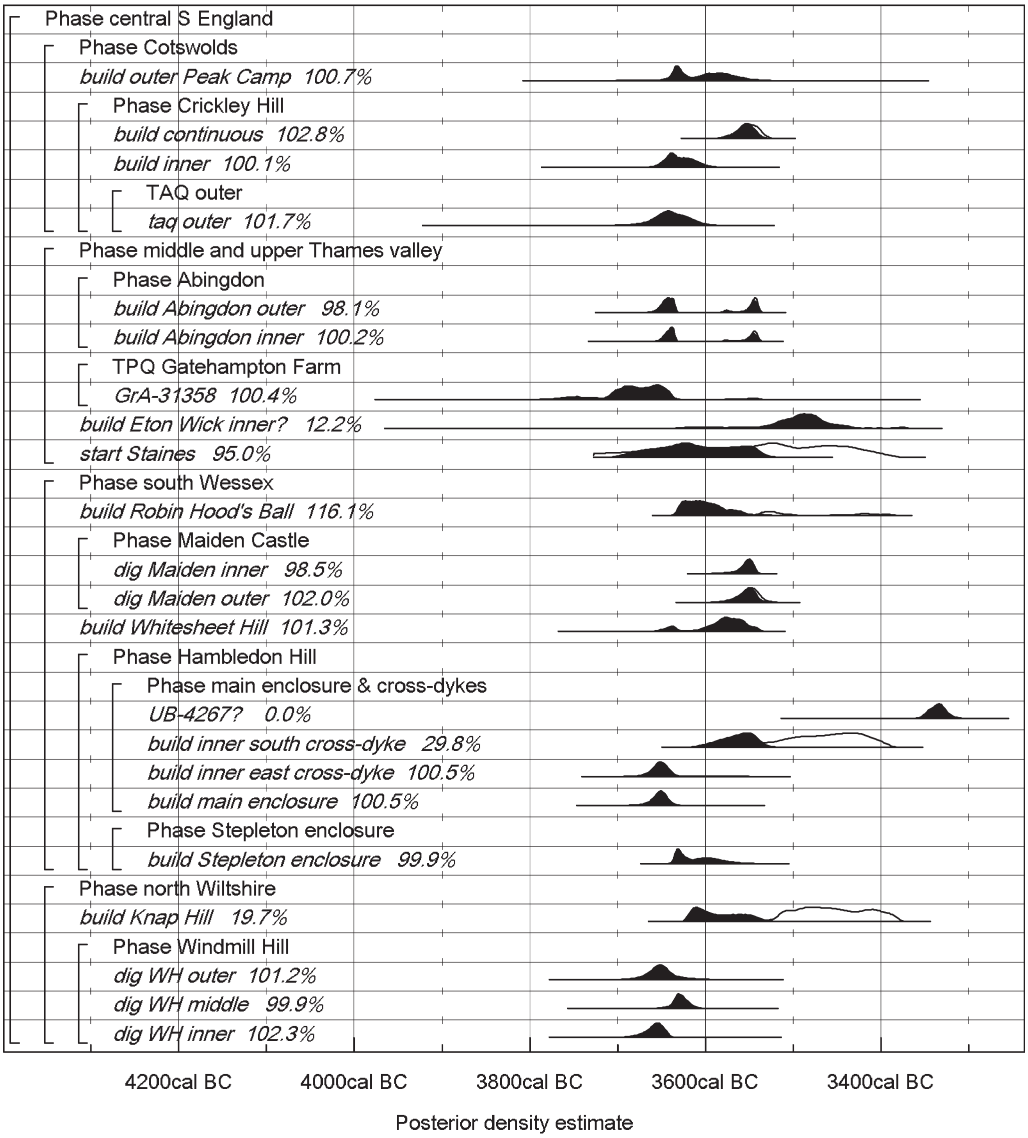


Fig. 14.9. Probability distributions of construction dates for circuits of causewayed enclosures from central-southern England. The format is identical to that for Fig. 14.1. The overall structure of this model is shown in Fig. 14.7, and its other components in Figs 14.8 and 4.10.

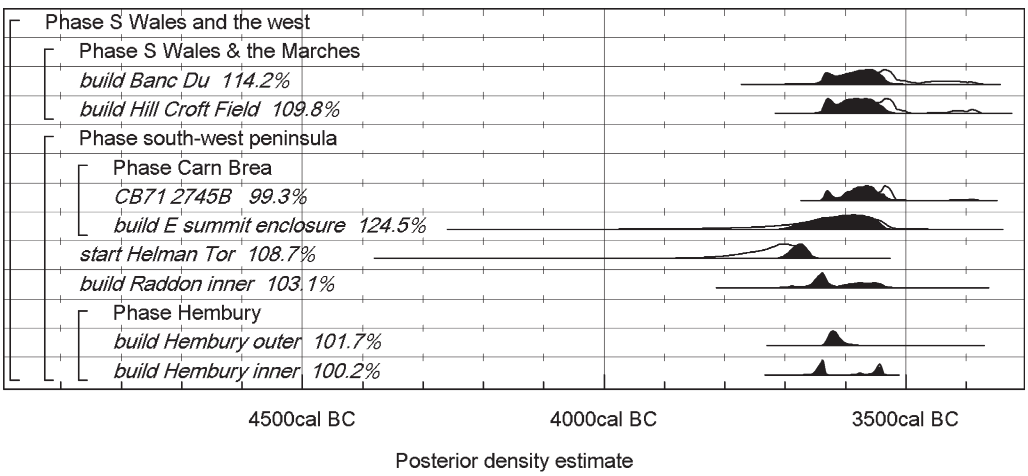


Fig. 14.10. Probability distributions of construction dates for circuits of causewayed and related enclosures from south Wales and the west. The format is identical to that for Fig. 14.1. The overall structure of this model is shown in Fig. 14.7, and its other components in Figs 14.8–9.

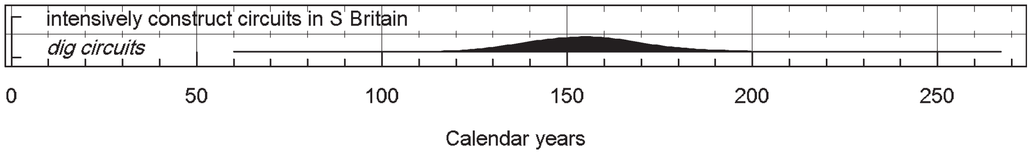


Fig. 14.11. Probability distribution of the number of years during which most of the circuits of the causewayed and related enclosures in southern Britain were constructed, derived from the model shown in Figs 14.7–10.

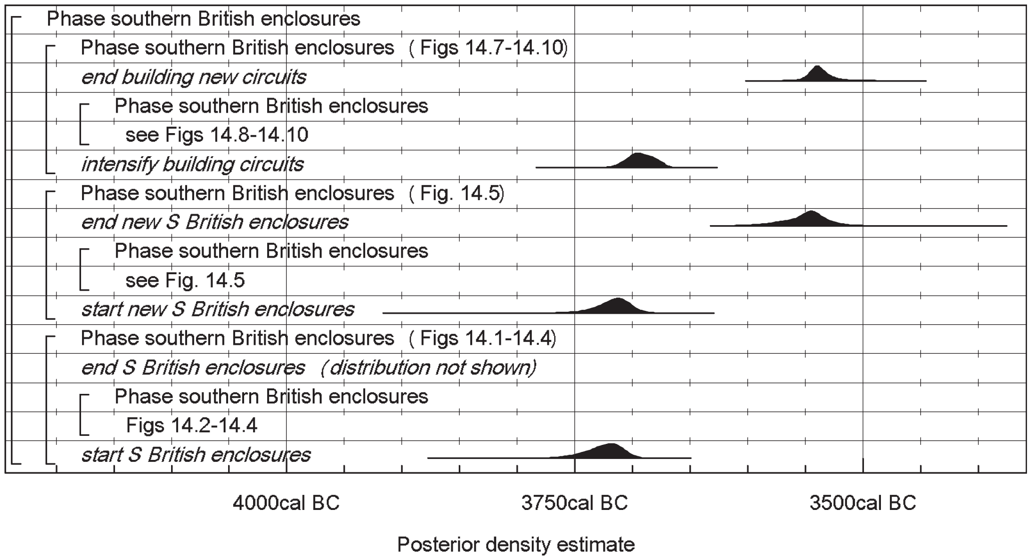


Fig. 14.12. Estimates for the date when the first causewayed and related enclosure was constructed in southern Britain, derived from the models defined in Figs 14.1–4, Fig. 14.5, and Figs 14.7–10, and for when the phase of construction ended according to the models shown in Fig. 14.5 and Figs 14.7–10.

the construction of causewayed and related enclosures in southern Britain. The models for the overall currency of southern British enclosures (Figs 14.1–4) and for the foundation of enclosures in this area (Fig. 14.5) agree in placing the construction of the first enclosure in the last quarter of the 38th century cal BC (Fig. 14.12: *start S British enclosures* and *start new S British enclosures*). The model for the intensive period of circuit construction provides an estimate which is significantly later, falling in the first quarter of the 37th century cal BC (Fig. 14.12: *intensify building circuits*). Each model estimates the dates of slightly different archaeological events (Fig. 14.13). The model shown in Fig. 14.5 estimates the time when the first enclosure was established, and the model defined in Figs 14.1–4 estimates the time when the first enclosure came into use. The times of these two events were presumably in reality very close, and the date estimates from these models are practically identical (Fig. 14.12). The third model (Figs 14.7–10) considers the period of intensive circuit building, and so *intensify building circuits* estimates the time when this more concentrated activity began. The difference between *start S British enclosures* and *intensify building circuits* therefore provides an indication of the tempo of the introduction of the enclosure phenomenon. This occurred within *−10–75 years* (*95% probability*; Fig. 14.14: *introduce enclosures*), probably within *10–50 years* (*68% probability*). From the shape of this probability distribution, it is apparent that it took a generation or so for this new practice to become more widely established.

The spread of enclosures

Turning now to the spatial dimension of the introduction of causewayed and related enclosures across southern Britain, the time when the first dated enclosure in each of our regional chapters was constructed, derived from the model shown in Figs 14.7–10, is shown in Fig. 14.15. It should be noted that this estimate does not relate to any particular dated enclosure in a region, but rather combines the earlier parts of the date estimates for each of the dated enclosures to produce a new estimate for the time when the first of the enclosures was established (and see Chapter 2.4.1). Enclosures do not seem to have appeared in all regions at the same time. They were established first in regions with south- or east-facing coastlines, in eastern England, the Thames estuary, Sussex and the south-west peninsula (Fig. 14.16), probably first on the Thames estuary. It is *more than 75% probable* that the first dated enclosure in the Thames estuary was earlier than the first dated enclosure in any other region. The idea of enclosure seems to have spread from the coast first to Wessex, perhaps in the second quarter of the 37th century cal BC, then to the Cotswolds and the middle and upper Thames valley, perhaps in the third quarter of the 37th century cal BC,

Table 14.1. Estimates of ditch length for the dated earthworks included in Figs 14.19–23.

Site	Ditch	Ditch length (m, rounded)	Worker days, where available (rounded)
A. Sites with resource estimates			
Abingdon	Inner	200	140 without turf revetment (Startin 1982a)
Abingdon	Outer	310	960 without turf revetment (Startin 1982a)
Haddenham		1110	2670 (Evans and Hodder 2006, 316)
Hambledon Hill	Main enclosure	1000	7015 with timber box frame 5520 earthmoving alone (Mercer 2008b)
Hambledon Hill	Inner E cross-dyke	280	1205 with timber box frame 500 earthmoving alone (Mercer 2008b)
Hambledon Hill	Inner S cross-dyke	170	1110 with timber box frame 700 earthmoving alone (Mercer 2008b)
Hambledon Hill	Shroton outwork	290	2685 with timber box frame 1960 earthmoving alone (Mercer 2008b)
Hambledon Hill	Stepleton enclosure	375	1795 with timber box frame 860 earthmoving alone (Mercer 2008b)
Hambledon Hill	Inner Stepleton outwork	300	2420 with timber box frame 1670 earthmoving alone (Mercer 2008b)
Hambledon Hill	Middle Stepleton outwork	500	2460 with timber box frame 1210 earthmoving alone (Mercer 2008b)
Hambledon Hill	Outer Stepleton outwork	500	2885 with timber box frame 1640 earthmoving alone (Mercer 2008b)
Windmill Hill	Inner	230	160 (Startin 1982b)
Windmill Hill	Middle	690	1310 (Startin 1982b)
Windmill Hill	Outer	1130	4810 (Startin 1982b)
B. Others			
Banc Du	Inner	700	
Bury Hill		430	
Chalk Hill	Inner	250, calculated from estimated maximum diameter by excavator (Shand 2001, 8)	
Chalk Hill	Outer	530, calculated from estimated maximum diameter (Shand 2001, 16)	
Court Hill		600	
Etton		530	
Hembury	Inner	150, if earthwork simply cuts off spur	
Kingsborough 2		270, if earthwork indeed open on steepest side	

Site	**Ditch**	**Ditch length (m, rounded)**	**Worker days, where available (rounded)**
Knap Hill		560	
Maiden Castle	Inner	980	
Maiden Castle	Outer	1110	
Northborough	Innermost	490	
Offham Hill	Outer	340, if complete (Oswald *et al.* 2001, fig. 4.8)	
Orsett	Inner	310	
Orsett	Middle	490, if complete	
Orsett	Outer	530, if complete	
Peak Camp	Outer	150, if earthwork simply cuts off spur	
Raddon	Inner	310	
Robin Hood's Ball	Inner	390	
Whitehawk	DI	320	
Whitehawk	DII	400	
Whitehawk	DIII	640	
Whitehawk	DIV	830	
Whitesheet Hill		370	

and then to south-west Wales and the Marches towards the end of the 37th century cal BC. Figure 14.17 shows the tempo of the spread of enclosures from a notional centre in the Thames estuary – to south Wessex within one or two generations, to the middle and upper Thames valley perhaps within two generations, and to south-west Wales and the Marches in three or four generations.

At this point it is necessary to highlight the limitations of the current dataset. On the one hand, Figure 14.15 represents a real step forward in our understanding of Neolithic chronology, since we are now able to consider change on a generational scale. On the other hand, the number of circuits which we have been able to date is limited, and if our sample is not representative, then even the relatively clear patterns shown in Fig. 14.15 may be spurious. We are conscious, for example, that for the upper Thames only Abingdon has been dated, and more than a dozen other enclosures are known only as cropmarks. It is obvious that Abingdon could simply be a late example within its regional sequence. A second reservation relates to the technical limitations of the model defined in Figs 14.7–10. We have already discussed the problem of defining the end of the phase of circuit construction, but are also concerned that the date estimates for different circuits within the same site are not statistically independent, since they derive from overall site-based models.

For these reasons, another model has been constructed which estimates the date when the first site was established in a number of areas in southern Britain (Fig. 14.18). This is of the form shown in Fig. 14.5. There are insufficient dated sites to enable this approach to be applied to each region covered by the individual chapters, and so, on the basis of the pattern shown in Fig. 14.15, we have amalgamated some regions into areas. The Thames estuary, eastern England and Sussex are grouped as south-east England for these purposes; the south-west peninsula stands as a region, though here dated sites are in particularly short supply; and south Wessex, north Wiltshire, the middle and upper Thames valley, and the Cotswolds have been combined to form central-southern England. There are too few dated sites in south-west Wales and the Marches for this region to do other than stand alone. The same spatial pattern is apparent in this analysis, with the enclosures in south-east England and the south-west peninsula being slightly earlier than those in central-southern England, and those in both being perhaps more substantially earlier than

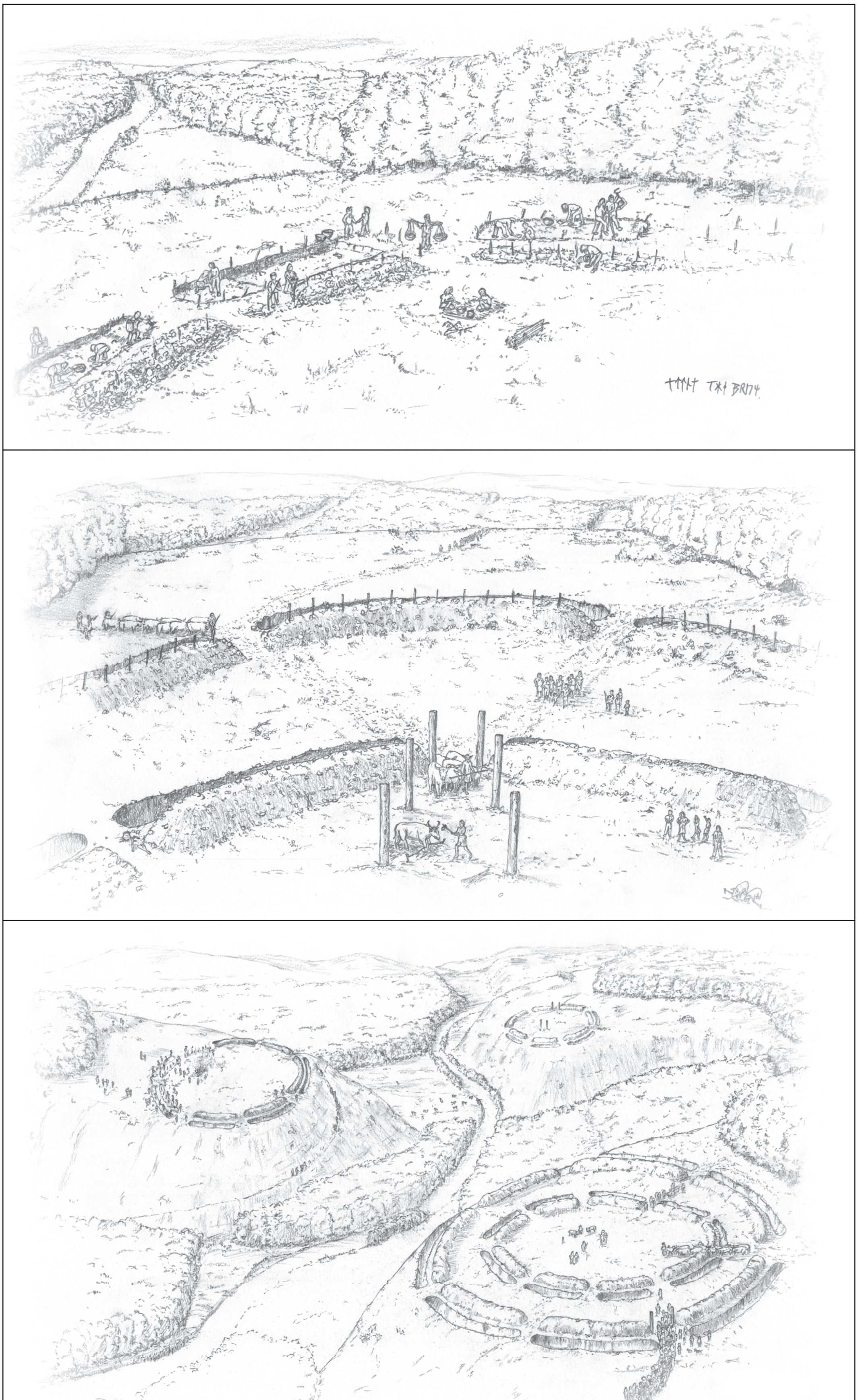


Fig. 14.13. Illustration showing the archaeological differences between the date estimates for southern Britain shown in Fig. 14.12: (top) the time when the first enclosure was established (Fig. 14.5), (middle) the time when the first enclosure came into use (Figs 14.1–4) and (lower) the time when the intensive period of circuit construction began (Figs 14.7–10).

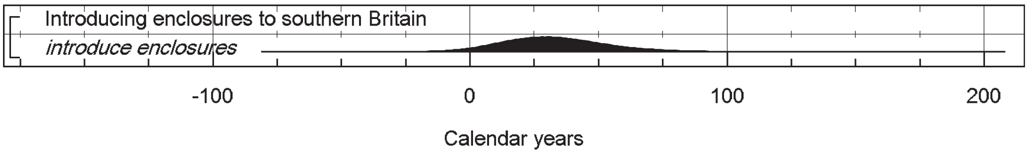


Fig. 14.14. Probability distribution for the speed of the introduction of causewayed and related enclosures to southern Britain (calculated as the difference between start S British enclosures *(Figs 14.1–4) and* intensify building circuits *(Fig. 14.7–10)).*

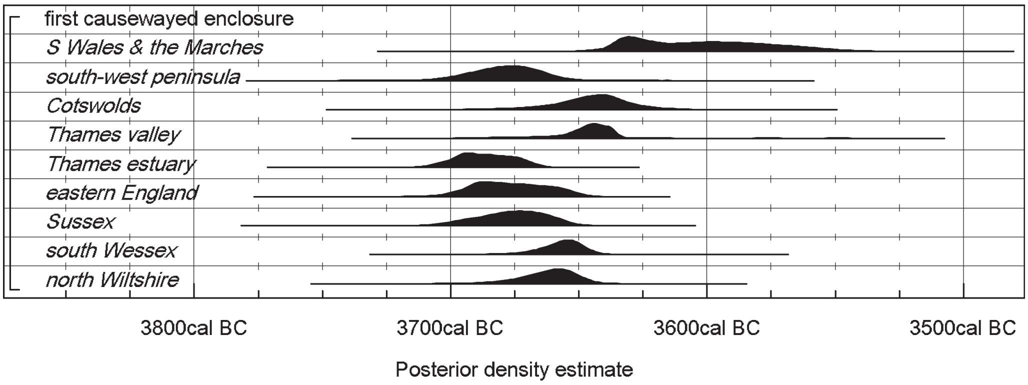


Fig. 14.15. Probability distributions for the first dated enclosure in each of our regional chapters, derived from the model shown in Figs 14.7–10.

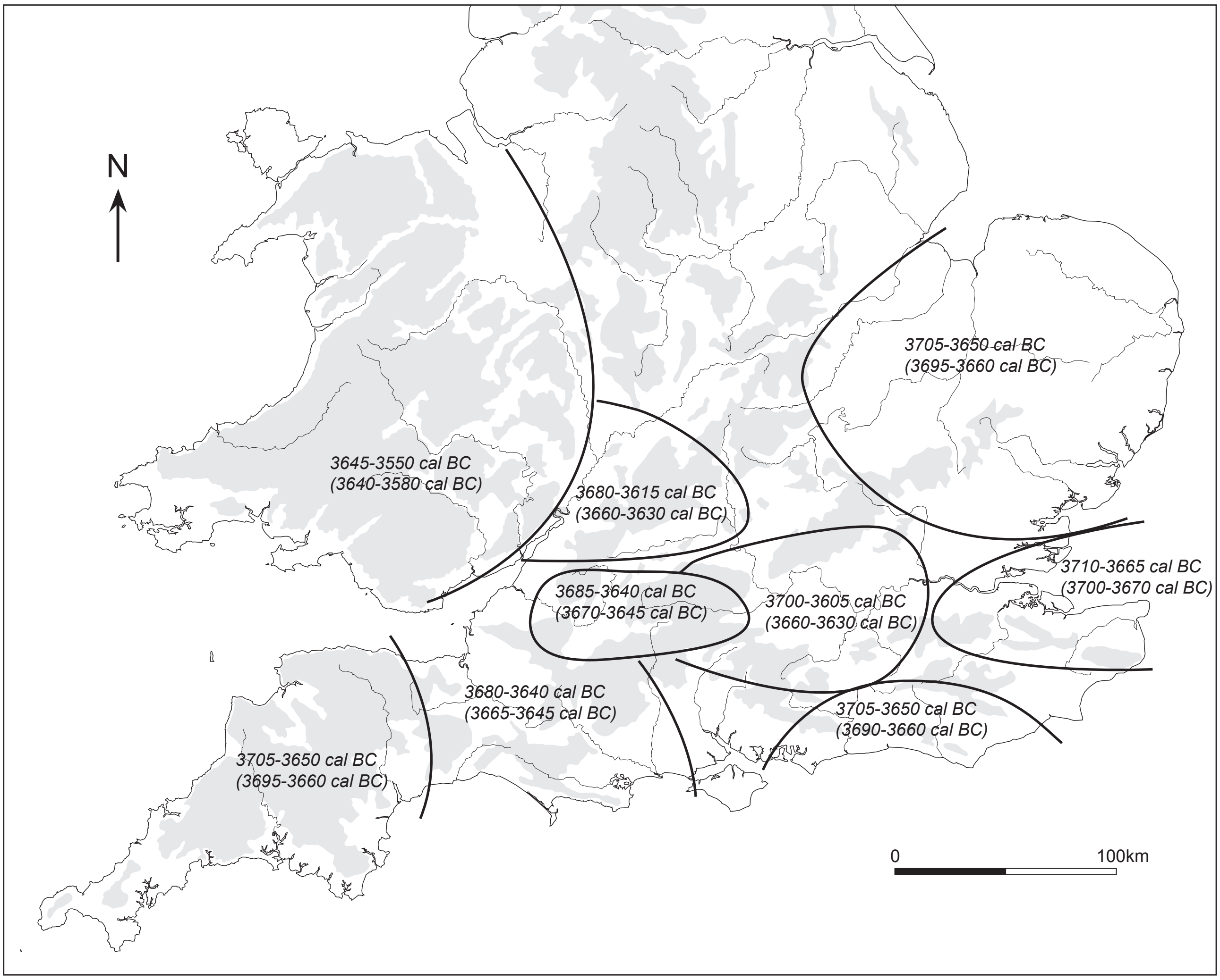


Fig. 14.16. Map showing the spread of causewayed and related enclosures across southern Britain, at 95% probability (68% probability in brackets).

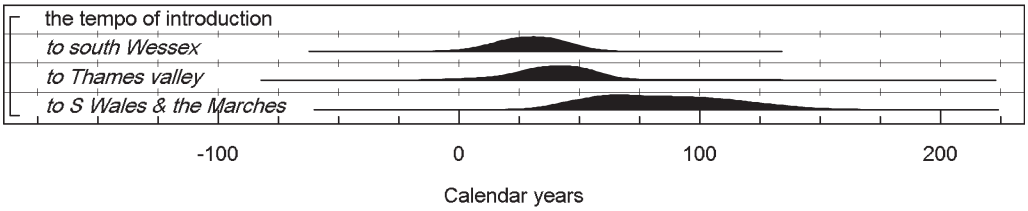


Fig. 14.17. Probability distributions for the number of years required for the spread of causewayed and related enclosures to selected regions of southern Britain (from a notional origin in the Thames estuary), derived from the model shown in Figs 14.7–10.

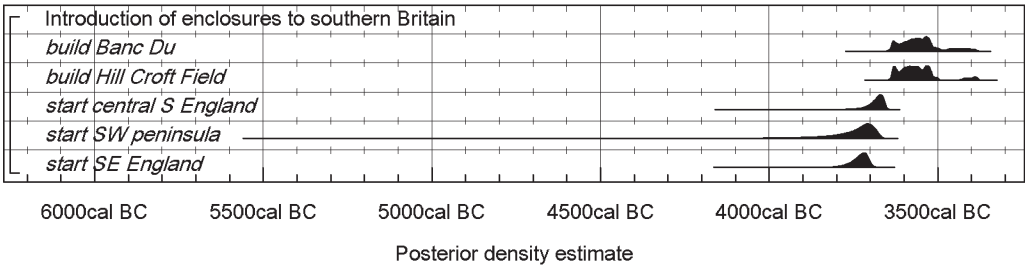


Fig. 14.18. Probability distributions for the start of enclosure by area, derived from the model shown in Fig. 14.5.

those in south-west Wales and the Marches (Fig. 14.18). This sensitivity analysis reassures us that the temporal and spatial trends which we have suggested for the introduction of enclosures across southern Britain are realistic.

The effort of construction

From the date estimates for the causewayed and related enclosures in southern Britain set out in Chapters 3–11, we are also now in a position to consider the effort expended by successive generations of people in the task of constructing ditch circuits. It is of course no easy matter to make calculations of labour requirements for enterprises of this kind. On the one hand, it is often far from straightforward to calculate both the total length of a circuit and the total volume of a given ditch segment, let alone that of a whole circuit. On the other, it is difficult to know how quickly Neolithic people could have dug a given volume of different subsoils such as chalk, greensand or gravel, with the tools available. The formulae most often employed (e.g. by Startin 1982a; 1982b; Startin and Bradley 1981; Mercer 2008b; A. Chapman 1985; Evans and Hodder 2006) are based on a combination of standard figures for manual labour in the eighteenth and nineteenth centuries, and of observations from recent experimental earthworks built without metal tools.

For calculating the effort of construction, we have used the estimated dates for the construction of ditch circuits provided by the site-based models detailed in Chapters 3–11. This means that we have avoided the problem of defining the end of the phase of circuit construction apparent in the model defined in Figs 14.7–10. We have used two approaches, the adoption of resource estimates already calculated for a minority of excavated enclosures by what are essentially the methods of a quantity surveyor and a simpler calculation based on ditch lengths alone, which applies to a wider sample of sites.

We have drawn on existing calculations of resource estimates for a small set of circuits, at Abingdon (Startin 1982a), Haddenham (Evans and Hodder 2006, 316), Hambledon Hill (Mercer 2008b), and Windmill Hill (Startin 1982b). In each case calculations have been made of the total volume of material extracted from the ditches and hence of the labour required to dig them and build the accompanying banks. In some cases this has been accompanied by estimates for other elements, notably timber rampart structures or palisades (Table 14.1). We then calculated for each circuit for which such estimates were available the probability that it was constructed in a given 25-year period, and multiplied this figure by the worker days required for the circuit (e.g. there is a 68.8% chance that the inner ditch at Windmill Hill was dug between 3650 and 3625 cal BC and, since the inner ditch required 160 days work, proportionately 110 worker days (68.8% of 160) were employed for this circuit in this time period). The figures for all the relevant circuits were totalled for the given time period and this figure divided by the total number of worker days required for the construction of all the relevant earthworks. So for example 7175 worker days were required for the earthworks constructed between 3650 and 3625 cal BC. As just over 27,000 worker days were required to construct all the relevant earthworks, 26.6% of the total effort was expended during this period.

The total effort expended in each 25-year period to construct these earthworks is shown in Fig. 14.19 (red line). It can be seen that there was a dramatic increase in building activity in the mid-37th century cal BC, which parallels the spread of the enclosure phenomenon at this time (Fig. 14.15). These estimates are practically identical whether the entire construction of the circuits is considered or just

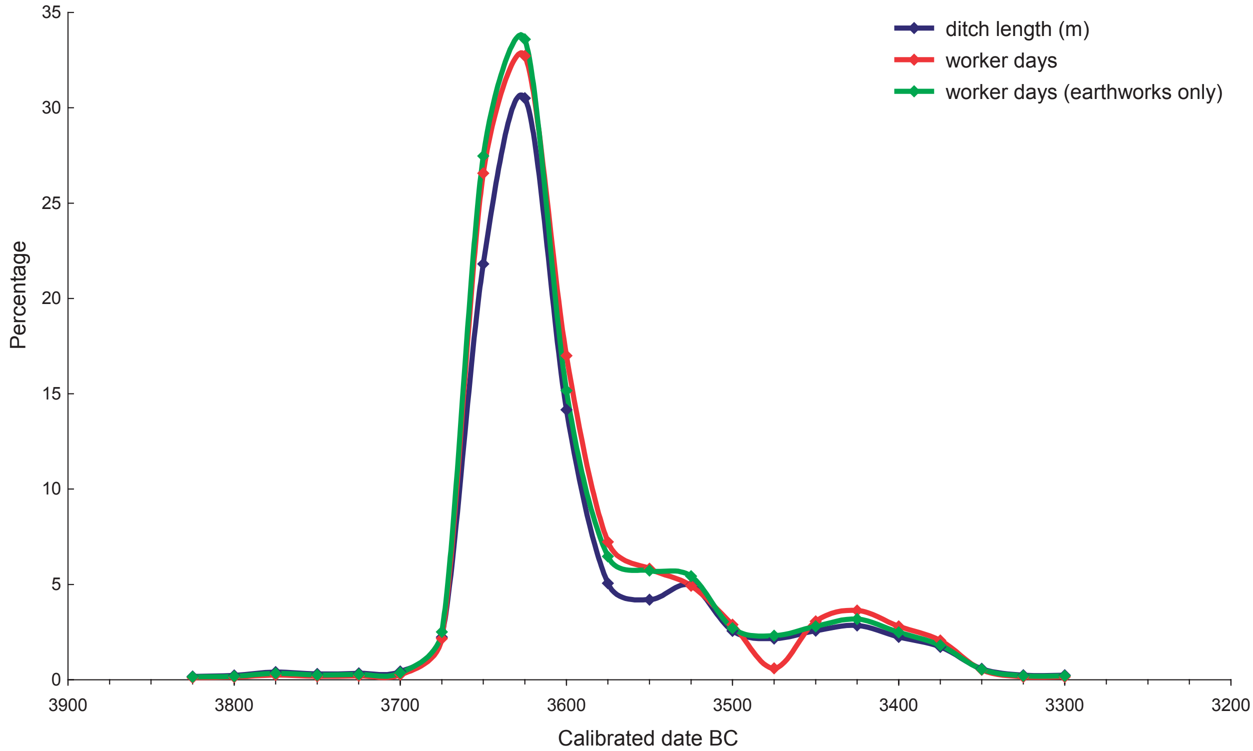


Fig. 14.19. Resource estimates for the construction of earthworks relating to the enclosures at Hambledon Hill (Mercer 2008b), Windmill Hill (Startin 1982b) and Haddenham (Evans and Hodder 2006) by 25-year period, compared with estimates based simply on ditch length. The red line includes estimates for timberwork at Hambledon Hill; the green line is based on earth-moving only.

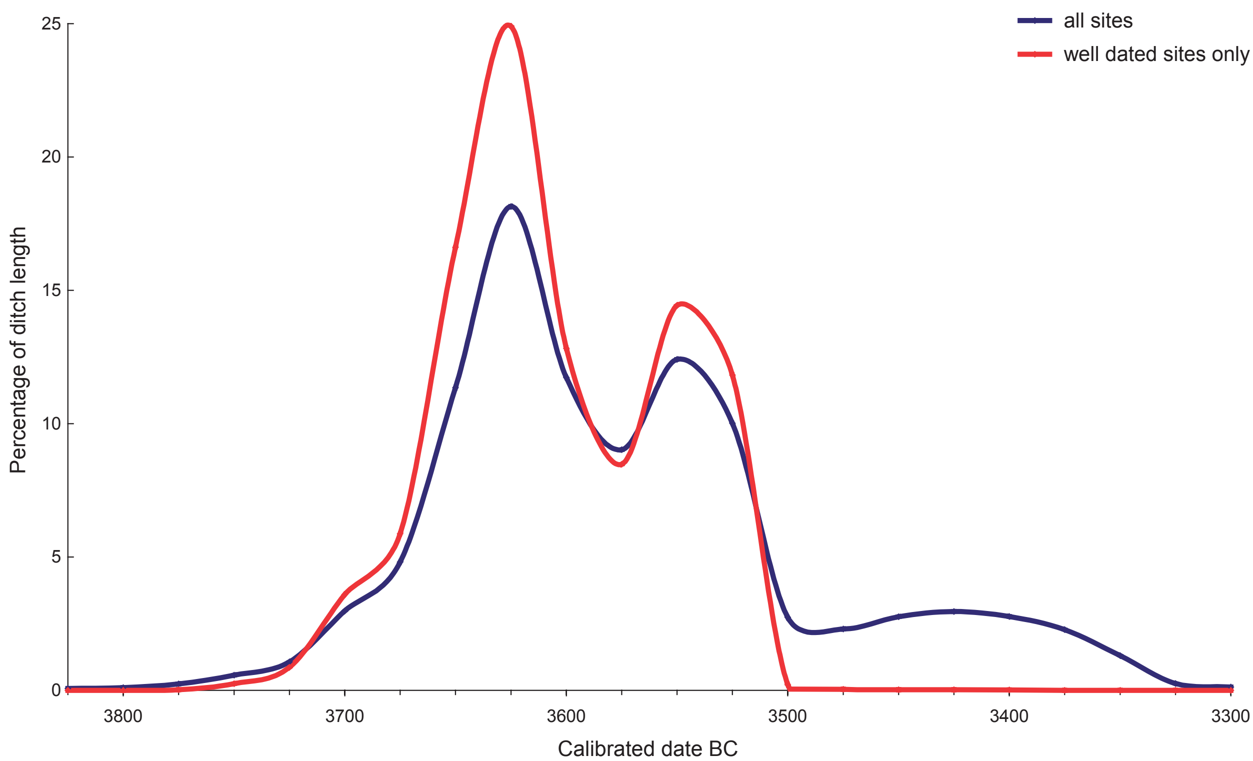


Fig. 14.20. Proportion of total ditch length excavated in each 25-year period for the circuits listed in Table 14.1. The red line includes circuits with estimated construction dates spanning less than a century; the blue line includes all the circuits.

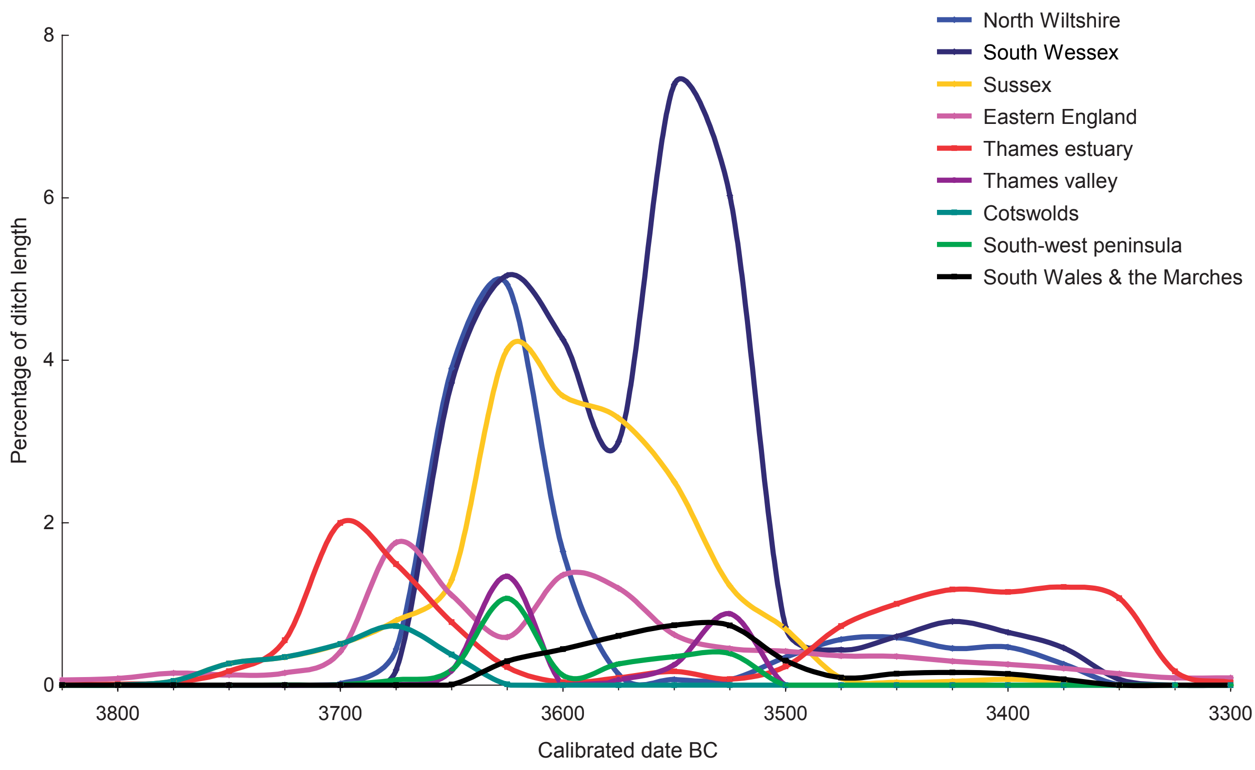


Fig. 14.21. Proportion of total ditch length excavated in each 25-year period for the circuits listed in Table 14.1, broken down by the regions covered in Chapters 3–11.

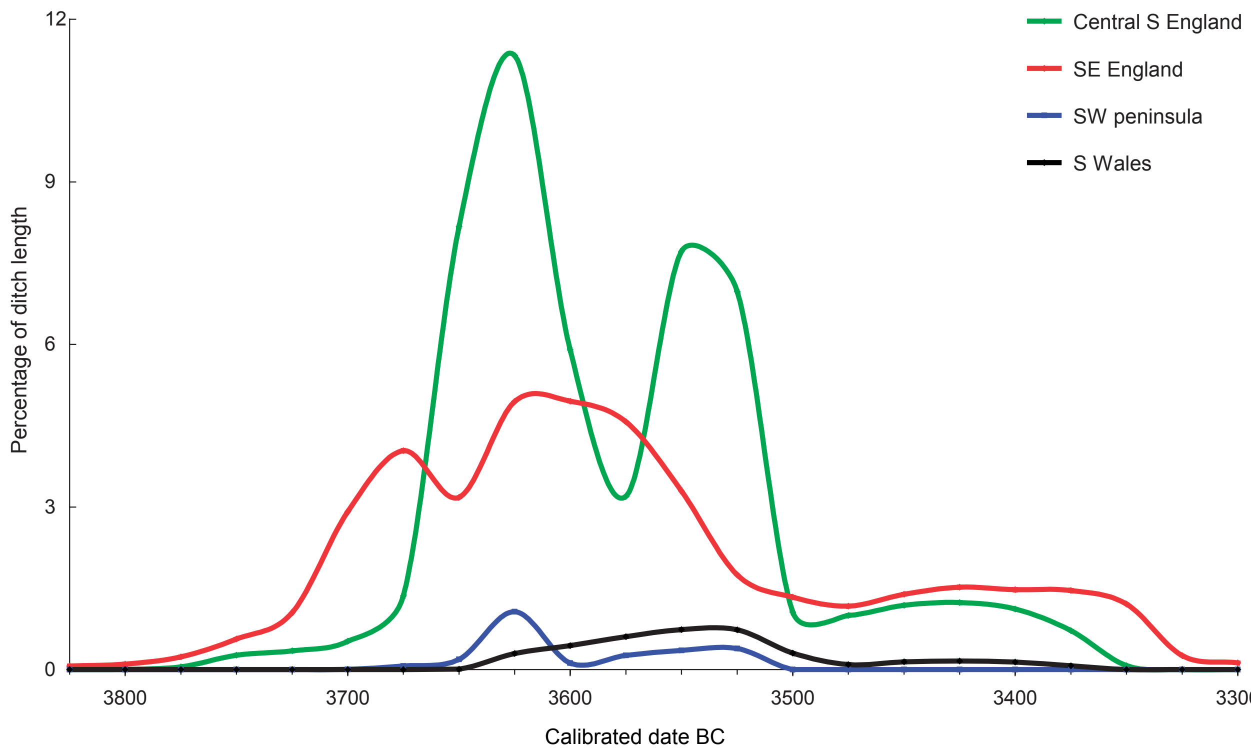


Fig. 14.22. Proportion of total ditch length excavated in each 25-year period for the circuits listed in Table 14.1, broken down by larger areas.

the excavations of the ditches (Fig. 14.19: green line). The estimate for the construction date of the Haddenham enclosure is so imprecise (Fig. 6.11: *start Haddenham*) that its resource estimate is spread so evenly across the time bands as to have little effect on the overall distribution. The estimate for the Haddenham palisade is omitted because the one date from that feature falls in the late third or early second millennium cal BC (Table 6.3: HAR-8094).

When these figures are compared with those calculated from simple estimates of the total lengths of the same circuits a very similar pattern emerges (Fig. 14.19: blue line). This much less sophisticated method thus seems to be a reliable proxy, at a coarse level, for resource estimates. The calculations have therefore been extended to include a much larger sample of earthworks for which the total ditch length can be reasonably estimated (Table 14.1). The proportion of total ditch length built in each twenty-five year period is shown for this larger sample in Fig. 14.20. A strongly bimodal pattern emerges, with the proportion of ditch length dug rising steeply from the second quarter of the 37th century and then falling sharply from *c*. 3625 cal BC to a low around 3575 cal BC. A second period of intensive construction followed in the middle decades of the 36th century cal BC. When the validity of this pattern is assessed by restricting the sample to those circuits with estimated construction dates spanning less than a century, an even stronger bimodal pattern emerges, confirming the legitimacy of the original analysis (Fig. 14.20). This cycle of resource expenditure cannot be explained as an artefact of the radiocarbon calibration curve. If we had sampled circuits which were really constructed in the first quarter of the 36th century cal BC, the methodology at our disposal would accurately estimate the date of sites constructed at this time (Bayliss *et al.* 2007a, 11–13). For example, the construction of Wayland's Smithy I occurred in *3610–3550 cal BC* (*83% probability*; Whittle *et al.* 2007b, fig. 4: *start_Wayland's Smithy I*) or *3545–3525* (*12% probability*), probably in *3590–3555 cal BC* (*67% probability*) or *3540–3535 cal BC* (*1% probability*). Figure 14.20 demonstrates that enclosure building caught on quickly and that within a generation or two there was a massive increase in the proportion of resources devoted to circuit construction. Intensive circuit building continued into the last quarter of the 36th century cal BC, although there was a noticeable reduction at the beginning of that century. Explanations are now required for the reduced effort expended on enclosure construction during the early decades of the 36th century cal BC. Building enclosures was still important to people at this time, although for whatever reason fewer resources were devoted to this task.

Regional trends, following the areas covered in the regional chapters of this volume, are illustrated in Fig. 14.21. It is apparent that there are not just variations in the expenditure of effort on circuit construction over time, but also spatial variations. For example, in the earliest phase, a much higher proportion of total construction occurred in the Thames estuary. As Chalk Hill shows, multiple circuits are part of the first manifestation of the enclosure idea. Construction in Wessex did not really get under way until the second quarter of the 37th century cal BC, but for the next 150 years effort was concentrated on the large enclosures of this region (Fig. 14.21). The resources expended on circuit construction in central-southern England are distributed in a strongly bimodal fashion (Fig. 14.22), mirroring the bimodality apparent in the overall expenditure of resources (Fig. 14.20) and accentuating the pattern evident for south Wessex (Fig. 14.21). The second peak of the distribution here is more pronounced than the earlier one, and may perhaps be synchronous with the greatest intensity of enclosure construction in south Wales and the Marches (Fig. 14.21).

In Wessex, the mid- to late 37th century cal BC saw considerable effort put into the construction of the large enclosures on Hambledon Hill and Windmill Hill, followed by a lull in the early 36th century cal BC when these sites remained in use but constructional activity was less intense. Taking those two sites as the largest of the reliably dated enclosures, it can also be noted that the biggest sites were not the earliest. In the second half of the 36th century cal BC, major new construction began again, at Maiden Castle and in the form of the inner Stepleton outwork at Hambledon Hill. This pattern of resource expenditure, however, is not entirely a product of the three big Wessex enclosures. Reliable estimates for the original size of the enclosures on Crickley Hill could not be included in this analysis because erosion and quarrying on the flanks of the spur make it impossible to know whether any of them originally extended along the south-east side (Fig. 9.2). Crickley was not large; if the circuits were all complete, the inner causewayed ditch would have been of similar length to that of the Stepleton enclosure on Hambledon Hill, and the outer causewayed ditch and the continuous ditch of similar length to that of the Etton enclosure. It is probable that the Crickley causewayed enclosure (both inner and outer circuits) was constructed on the first peak of constructional effort and that the continuous circuit there was built on the second. This may support the reality of the observed pattern, though uncertainties remain. For example, it is possible that the undated circuit at Robin Hood's Ball or the Rybury enclosure could fall in the suspected lull, although neither represents an investment of labour on the scale of the biggest Wessex enclosures.

Figure 14.22 does not show a similar pattern for other regions of southern Britain. That does not mean that this or similar cyclic patterns in the expenditure of effort were absent, only that none can currently be detected. To the east, the use of St Osyth seems to fall on one or other of the constructional peaks identified in Wessex, but here only the general currency of the site, not the individual circuits, has been dated. The other massive enclosure in eastern England, Haddenham, is not dated with sufficient precision to contribute here, but may represent another concentrated effort (as indeed argued by the excavators: Evans and Hodder 2006, 317). Generally, the enclosures in eastern England are not well dated, which obviously blurs any possible pattern. In the south-west, only the inner

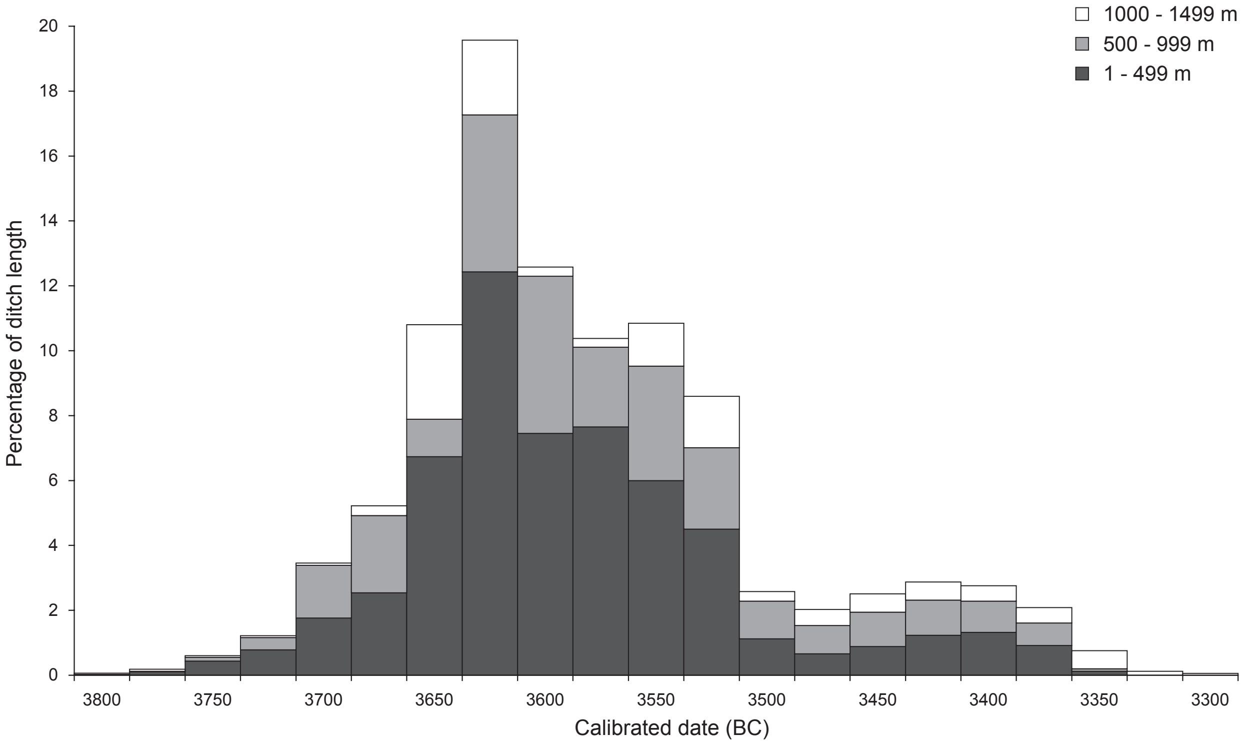


Fig. 14.23. Proportion of total ditch length excavated in each 25-year period for the circuits listed in Table 14.1, broken into categories by the ditch length of the dated circuits.

circuit at Hembury and the inner circuit at Raddon can be included in this analysis. The constructions of the outer circuit at Hembury and of the Helman Tor tor enclosure, however, probably both fall before *c*. 3650 cal BC. The outer enclosure (that is, the inner ramparts joining the two summits: see Chapter 10) at Carn Brea, if they form an outer circuit to the Neolithic complex there, would represent another major effort.

From the last quarter of the 36th century cal BC, much less effort was expended on the construction of new circuits, although some new earthworks were still built (Fig. 14.23). For example, the outer east cross dyke on Hambledon Hill was modified at the very end of the currency of causewayed enclosures in southern Britain (Fig. 14.10: *UB-4267*). Overall, 81% of the total effort on construction was expended between 3700–3500 cal BC, and 18% between 3500–3300 cal BC, most of the remainder falling in the last quarter of the 38th century cal BC.

Multiple circuits and multiple enclosures

Figure 14.24 shows the estimated construction dates, derived from the site-based models defined in Chapters 3–11, for the circuits of all enclosures in southern Britain with more than one dated circuit. As discussed above, UB-4267 from the outer east cross-dyke of the main enclosure on Hambledon Hill has been excluded from the model since this estimate appears to relate to an extension rather than the initial construction of this earthwork. For the causewayed enclosure on Crickley Hill and for the Northborough enclosure, strictly only *termini ante quos* are available for one of the circuits. The date estimates for both the eastern summit enclosure and for the inner ramparts at Carn Brea are shown in case the latter really form an outer Neolithic circuit at that site. It is evident that where multiple circuits have been dated, these are close in date if not precisely contemporary. Figure 14.25 shows the difference between the dates of both circuits where we have two dated circuits, or the period of construction (i.e. the difference between the first and the last dated circuit) where we have more than this. In all cases where there are two dated circuits, they could have been laid out and constructed as one enterprise. The exception, the circuits at Hembury, may be anomalous, because the construction of the inner circuit has been dated but only the destruction of the outer (Chapter 10). Alternatively, the circuits could have been constructed successively, but if so, the evidence suggests that this took place relatively rapidly, probably within a generation or two, and certainly within a single human lifespan.

More complex enclosures took longer to construct. Windmill Hill was built over a period of *5–75 years* (*95% probability*; Fig. 14.25: *period construction* (*Windmill Hill*)), probably within a period of *20–55 years* (*68% probability*). At Whitehawk, where four circuits have been dated with varying degrees of precision, construction took *20–145 years (95% probability*; Fig. 14.25: *period construction* (*Whitehawk*)), probably *45–110 years* (*68% probability*). In both cases, it is possible that the project was conceived and brought to completion within a single adult

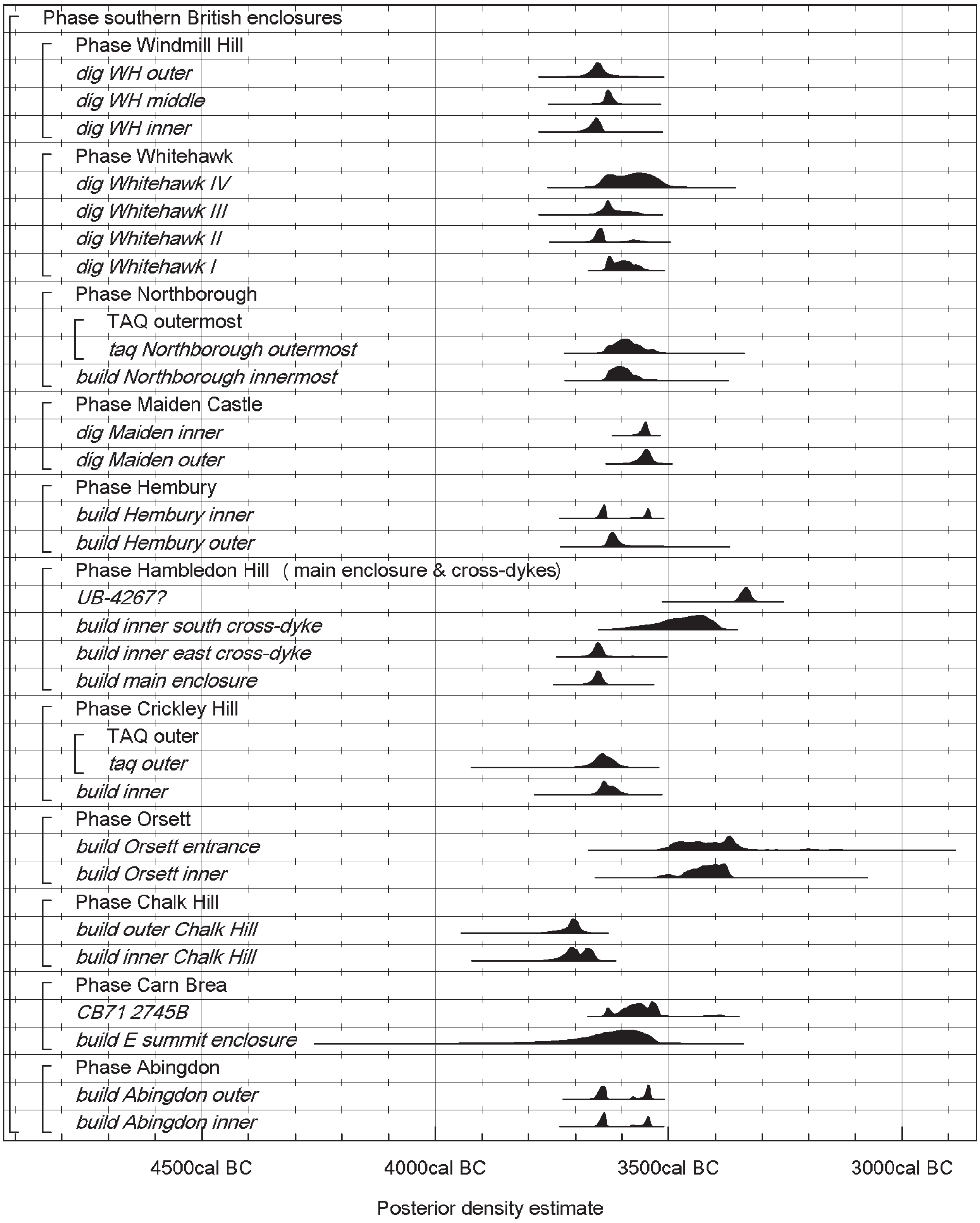


Fig. 14.24. Probability distributions of construction dates for circuits of causewayed and related enclosures from southern Britain which have more than one dated circuit. The format is identical to that for Fig. 14.1. The distributions are derived from the site-based models detailed in the captions to Figs 14.2–4.

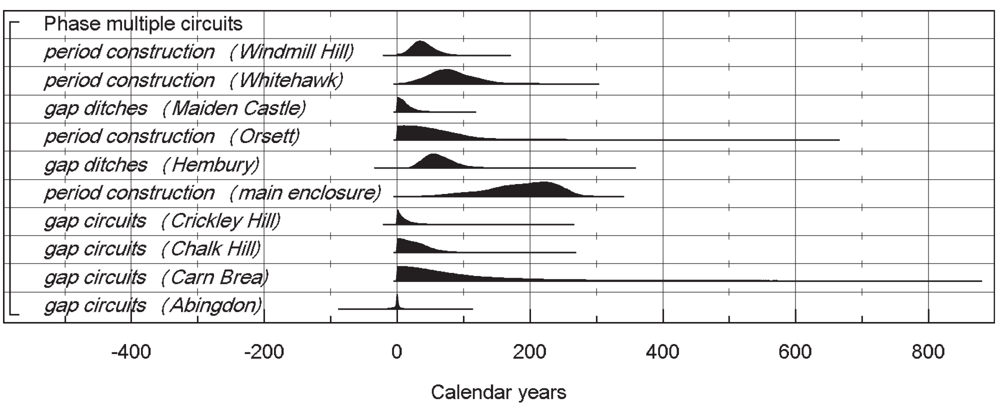


Fig. 14.25. Probability distributions showing the number of years required to construct enclosures from southern Britain with more than one dated circuit, calculated from the distributions shown in Fig. 14.24. 'Main enclosure' denotes the main enclosure on Hambledon Hill.

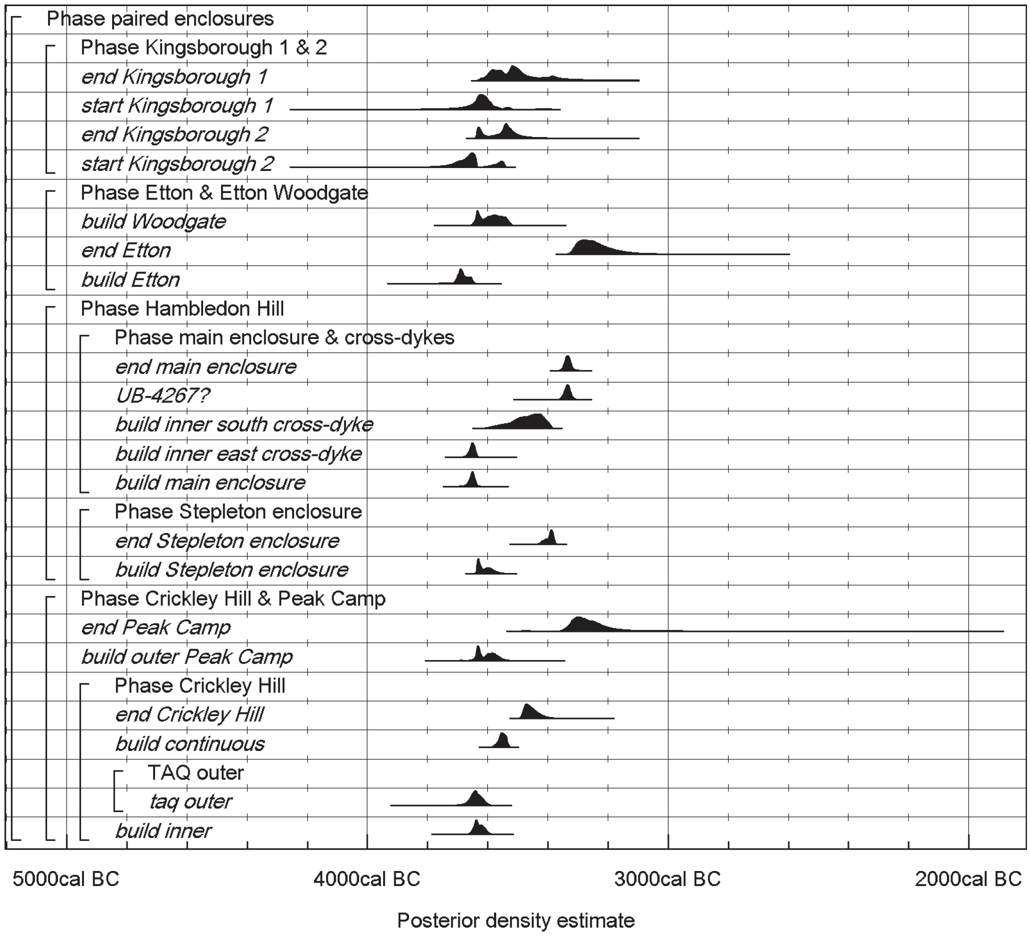


Fig. 14.26. Probability distributions for the construction and currency of pairs of enclosures from southern Britain which lie in close proximity. The format is identical to that for Fig. 14.1. The distributions are derived from the site-based models detailed in the captions to Figs 14.2–4.

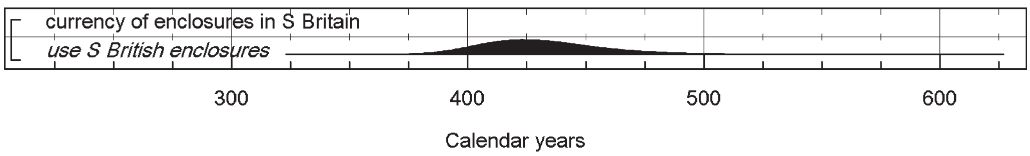


Fig. 14.27. Probability distribution for the number of years during which enclosures were in use in southern Britain, derived from the model defined in Figs 4.1–4.

lifetime. Such a tempo has significant social consequences and implications.

Much longer periods of construction are evidenced on Hambledon Hill. The question is whether this constitutes a similar phenomenon. If the cross-dykes are seen as effectively outer circuits (again excluding the probable modification of the inner east cross-dyke), the main enclosure took a substantial period to reach its final form, *85–270 years* (*95% probability*; Fig. 14.25: *period construction* (*main enclosure*)), probably *150–250 years* (*68% probability*). This estimate of the period of construction is realistic. Although the main enclosure and the inner east cross-dyke may be precisely contemporary (Fig. 14.24), the inner south cross-dyke, dated by UB-4268, an articulated cattle hock from beneath the bank (Table 4.2), was constructed substantially later.

If the outworks on the Stepleton spur also functioned as outer circuits, then this enclosure took *85–265 years* (*95% probability*; distribution not shown) to reach its final form, probably *110–135 years* (*12% probability*) or *155–245 years* (*56% probability*) – also a substantial period of time. Alternatively the Stepleton enclosure may have been conceived as a single circuit. The period of construction on Hambledon Hill suggests that it was significantly different from other sites. We have also already argued (Chapter 4) that the exceptionally extensive west-facing outworks late in the site sequence constitute a fundamental reorientation of the complex, transforming it from a causewayed

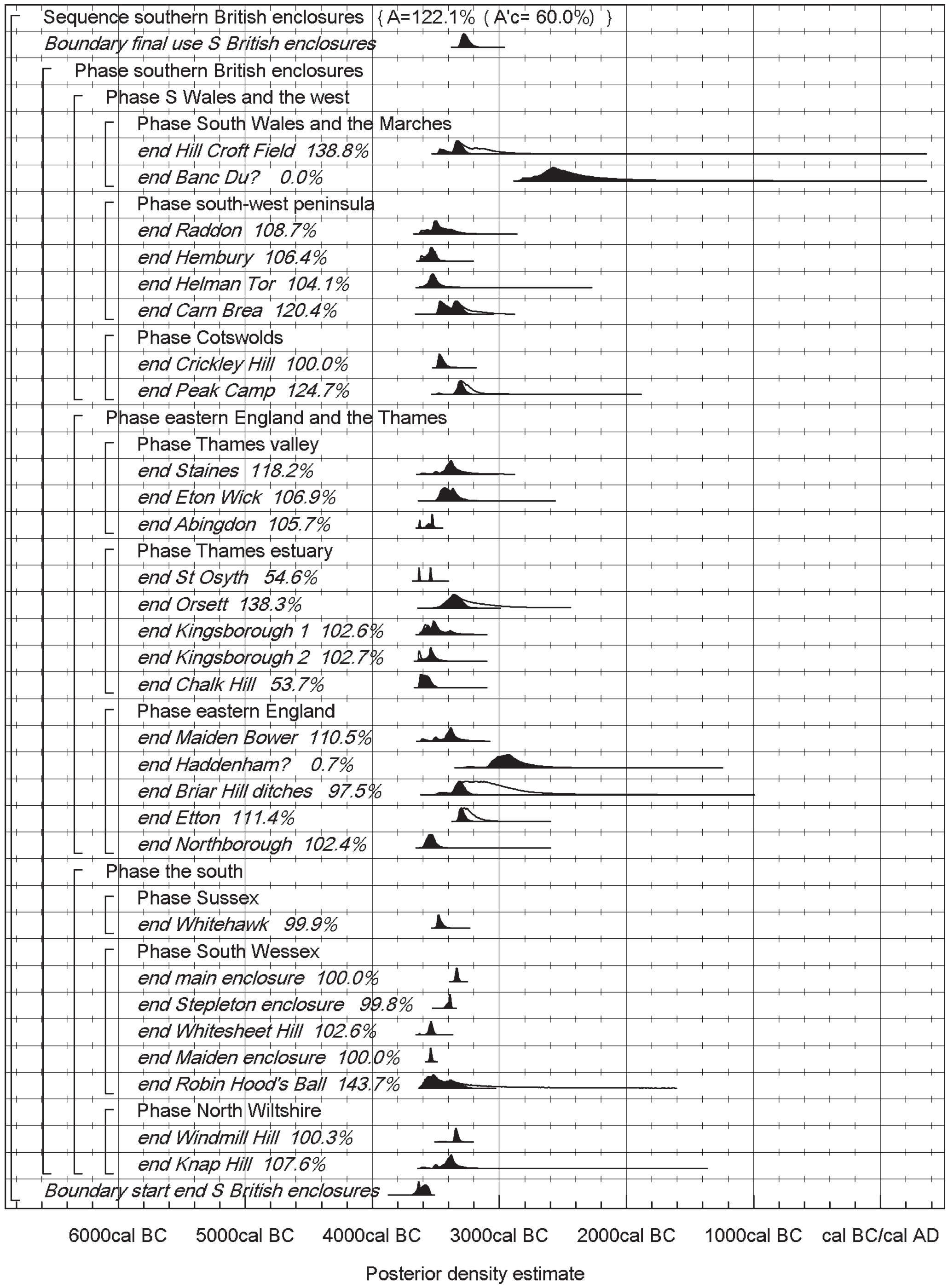


Fig. 14.28. Probability distributions for the dates of the end of causewayed and related enclosures in southern Britain. Distributions have been taken from the models defined in Chapters 3–11, as detailed in the captions to Figs 14.2–4. The format is identical to that for Fig. 14.1. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

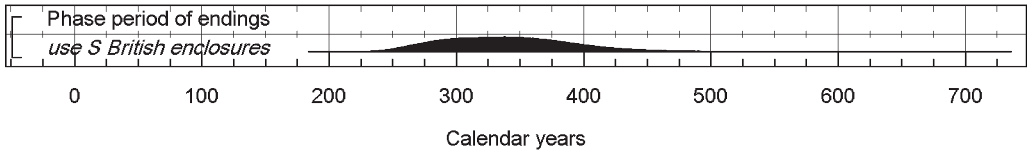


Fig. 14.29. Probability distribution for the number of years over which the primary use of causewayed and related enclosures in southern Britain ended, derived from the model shown in Fig. 14.28.

enclosure into something else. Once again, we have to deal with the implications of such a development for social relationships in the region.

Figure 14.26 shows the dates of construction and use for those enclosures which lie in such close proximity that they might have been conceived of as pairs. In all cases, the enclosures seem to have been constructed at different times. For example, the outer circuit at Peak Camp was probably built in the interval between the completion of both circuits of the causewayed enclosure and the inception of the continuous circuit at Crickley Hill (*73% probable*). It is almost certain (*more than 99% probable*) that the main enclosure at Hambledon Hill was constructed before the Stepleton enclosure there, and that Etton was initiated before Etton Woodgate. Kingsborough 2 is earlier than Kingsborough 1 (*71% probable*). In contrast, once built, these sites seem to have continued in concurrent use.

A similar trend may be apparent for the clusters of enclosures visible on Fig. 1.2. In East Sussex, the limited dating available for Combe Hill and Offham Hill, in addition to the rather more robust chronology available for Whitehawk (Fig. 14.2), may suggest a sequence of construction followed by contemporary use. In West Sussex, the tentative dating for Court Hill, Bury Hill and The Trundle is compatible with a similar pattern. The most convincing series are the three dated enclosures from the lower Welland valley, part of a wider cluster which embraces the lower Nene (Fig. 6.1), where again a sequence of construction followed by contemporary use is suggested (Fig. 14.3). Similarly, Windmill and Knap Hill, close to Rybury on the north Wiltshire downs, were built successively but were in use concurrently. Of the greater numbers in the upper Thames and the Cotswolds, only Abingdon, Crickley Hill and Peak Camp have been dated, and so the relationships are unknown.

The ending of enclosures

We have seen already that causewayed and related enclosures came to southern Britain in the late 38th century cal BC (Fig. 14.1: *start S British enclosures*) and continued in primary use until the decades around 3300 cal BC (Fig. 14.1: *end S British enclosures*) – over a period of *385–485 years* (*95% probability*; Fig. 14.27: *use S British enclosures*), probably of *400–455 years* (*68% probability*).

It is now time to consider when the enclosures, largely constructed in the 37th and 36th centuries cal BC, went out of use. This is more tricky. Defining endings raises several difficult questions. It could be argued that few such sites ever really had a definitive ending, because it can be in the nature of such earthworks to endure as visible traces, especially in prominent hilltop locations (in lower-lying locations the situation may often have been different), and people continued to use such places, perhaps both deliberately and coincidentally, and with varying degrees of intensity. Less frequented sites may still have carried considerable symbolic charge. The 'afterlife' of causewayed enclosures has already been discussed in these terms (Oswald *et al*. 2001, chapter 8). In the regional chapters, we have tried to demarcate a primary phase of use, defined partly by the nature of the ditch filling process and partly by associated deposition and material culture. Windmill Hill is a good case in point, with Peterborough and Beaker wares generally occurring from the upper secondary ditch fills upwards.[2] As discussed in Chapter 3, there was clearly continued use of the site from the late fourth millennium cal BC into the third, but the character of the use of the monument had changed. Other sites which were of much shorter duration included deliberately backfilled ditches, such as the case of the outer ditch at Maiden Castle, and ended within the currency of Bowl pottery.

In these terms, the endings discussed here relate to the substantial filling of the ditch circuits, particularly on unstable gravel and sand substrates, and the end of deposition associated with Bowl pottery. This is discussed in more detail on a site-by-site basis in the regional chapters. On this basis, a model for the period when the primary use of causewayed and related enclosures ended is shown in Fig. 14.28. The distributions for these endings have been taken from the site-based models defined in Chapters 3–11. As before, *end Banc Du* has poor agreement (A=38.1%) and so has been excluded from the model, and so does the ending of Haddenham (A=9.5%); this has also been excluded from the analysis. This model suggests that the primary use of the first enclosure ended in *3665–3540 cal BC* (*95% probability*; Fig. 14.28: *start end S British enclosures*), probably in *3645–3625 cal BC* (*20% probability*) or *3615–3555 cal BC* (*48% probability*). The first enclosure to go out of primary use did so whilst the period of intensive circuit construction (Fig. 14.7) was still underway (*99% probable*).

The last enclosure to go out of primary use did so in *3320–3195 cal BC* (*95% probability*; Fig. 14.28: *final use S British enclosures*), probably in *3305–3245 cal BC* (*68% probability*). This estimate encompasses the date for final use provided by the model for the overall currency of enclosures (Fig. 14.1), but is less precise as it depends on fewer data. Causewayed enclosures in southern Britain did not come to a sudden halt, but rather the period during which they went out of primary use spanned a period of *245–440 years* (*95% probability*; Fig. 14. 29: *disuse S British enclosures*), probably of *280–385 years* (*68% probability*). The staggered ending of the enclosure phenomenon stands in stark contrast to the swift tempo of its introduction. Different sites fell into disuse over a period of centuries, not the individual lifespans appropriate to the introduction of the phenomenon and the construction of most individual sites. Figure 14.30 shows the percentage of sites which went out of initial use in any given century. It is apparent that there is no single period when sites were more liable to go out of use. The overall pattern suggested when the endings of all sites are considered (except for Banc Du and Haddenham) is supported by the similar distribution produced when only the ten well dated sites (with endings estimated to within a century) are evaluated.[3]

The time when the first enclosure in a region went out of primary use may be varied. In most places, this happened in the 36th century cal BC, although in a few regions this may have happened over the succeeding centuries. There is no obvious spatial trend in this disuse, and the observed variation may as well relate to the number of well dated sites in a given region. In contrast, in most areas the last causewayed enclosure appears to have gone out of primary use in the 34th century cal BC. There may be a slight exception in eastern England, where activity may have continued for a few more generations (e.g. Fig. 14.28: *end Etton*). This trend might be even more apparent if Haddenham were included in the analysis. The imprecision of much of the dating in this region, however, must be acknowledged.

In relation to size and complexity of circuit layout, there are some signs of different trends. Figure 14.31 shows endings of enclosures by century against size, measured by total ditch length, and complexity as measured by numbers of circuits. It is apparent that both large and small enclosures could go out of use at any time within the span of the sequence of endings. Within this pattern, however, there may be a trend for smaller enclosures to come to an end earlier than larger ones. It is also apparent that both simpler and more complex enclosures could go out of use at any time within the span of the sequence of endings. Once more, however, there may be a tendency for more complex enclosures to endure in use after they were completed. This raises significant questions of the power of place and tradition.

The duration of enclosures

We turn now to the duration of enclosures, which can only be estimated once the start and end dates for each site have been established. As we have already seen, causewayed and related enclosures in southern Britain were in primary use for *385–485 years* (*95% probability*; Fig. 14.27: *use S British enclosures*), probably for *400–455 years* (*68% probability*). We can go on to look in more detail at the period of use of individual sites, as not all need have been in use for the entire currency of enclosures.

Figure 14.32 shows the probability distributions for the number of years in which the dated enclosures were in use. These distributions have been derived from the site-based models defined in Chapters 3–11. For a few sites, it has not been possible to estimate the period of use. At Bury Hill, for example, the only dated samples are from the ditch base and the initial silts, so that there is no indication from radiocarbon dating of how long activity continued at the site, although the absence of suitable samples from higher levels and the fact that ditches silted naturally without intervention argue for a short period of use followed by abandonment. Similar considerations apply at, among other sites, Kingsborough 2, Knap Hill and Offham Hill.

It is apparent that not all sites were in use for similar periods of time. To take examples from well dated sites where precise estimates of duration are possible, the large enclosure with three circuits at St Osyth may well have been in use for less than a generation (it is *91% probable* that this site was in use for less than 25 years). In contrast, it is *77% probable* that Windmill Hill was used for *300–350 years*. The use of St Osyth falls within the period of individual memory, while that of Windmill Hill probably extends beyond the span of active memory. The use of Chalk Hill (it is *83% probable* that Chalk Hill was in use for *50–125 years*) lies in the middle ground, within the span of memories which could have been transmitted between generations.

Figure 14.33 shows the proportion of dated sites which were used for different periods of time. The blue line, which includes all sites where we have been able to estimate durations of use, is anomalously smoothed and has a long tail, suggesting that some sites could have been used for many hundreds of years. This is almost certainly an artefact of radiocarbon dating, because, where there are insufficient measurements for the scatter on the radiocarbon dates to be evaluated, estimates of duration are imprecise and allow for longer periods of use than was the case in reality. For this reason, the analysis has been repeated using a sub-sample of 11 well dated sites where the duration has been estimated to within a span of 200 years at 95% probability.[4] This is the red line shown in Fig. 14.33. It can be seen that the tail of very long use beyond 400 years has disappeared. The peak constituted by a high proportion of sites going out of use within one or two generations of their construction is even more apparent from the subset of well dated sites. This analysis suggests that the primary use of *c*. 30% of sites lasted for less than 50 years. Approximately 80% of sites were used for less than 250 years, but a number of them were in use for more than 300 years.

Figures 14.34 and 14.35 show the duration of enclosures in southern Britain in relation to the complexity of their circuits and to area (using the same subset of 11 well dated sites). Both suggest similar, but not identical, trends. From Fig. 14.34 it is apparent that complex sites with up to three circuits accompanied less complex sites in rapid demise, over one or two generations. Whitehawk, with at least four circuits, is also to be found among those which lasted for less than 250 years. It is striking, however, that it is the more complex sites which tended to continue for 300 years or more. In relation to area of enclosure, it is apparent on Fig. 14.35 that it is not only the more complex but also the largest sites which tended to endure for longest (not just in terms of successive constructional activity but also in continuing use). Sites of varying sizes can be seen to end quite quickly, and Maiden Castle stands out as an extremely large enclosure with an extremely brief life.

It must be recognised that this analysis is based on a small number of sites, and so it is necessary to consider whether these trends are representative of the wider set of southern British enclosures. The large, complex enclosures which endured, shown on Figs 14.34 and 14.35, are Windmill Hill and the main enclosure on Hambledon Hill. From the larger sample of less well dated sites, Etton, a small, simple enclosure, seems to have continued for as long (or even longer). Potentially long-lived sites such as

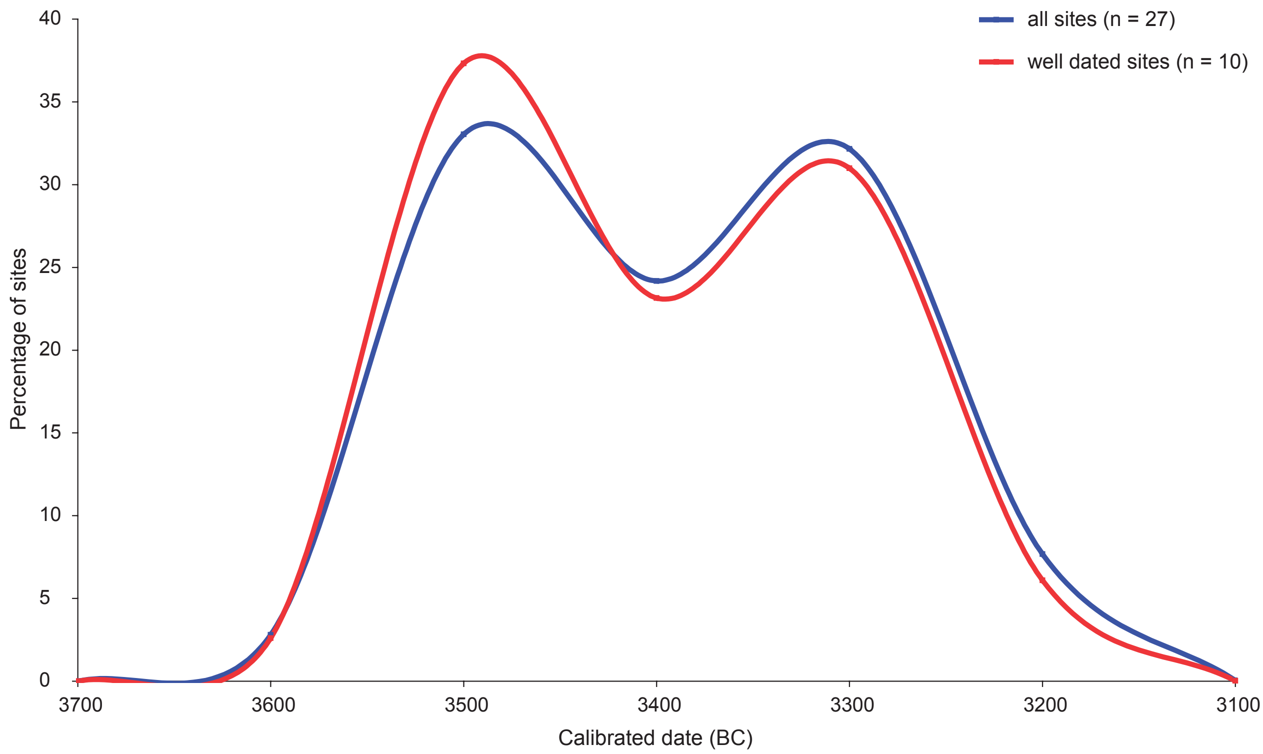


Fig. 14.30. Percentage of southern British enclosures going out of primary use by century.

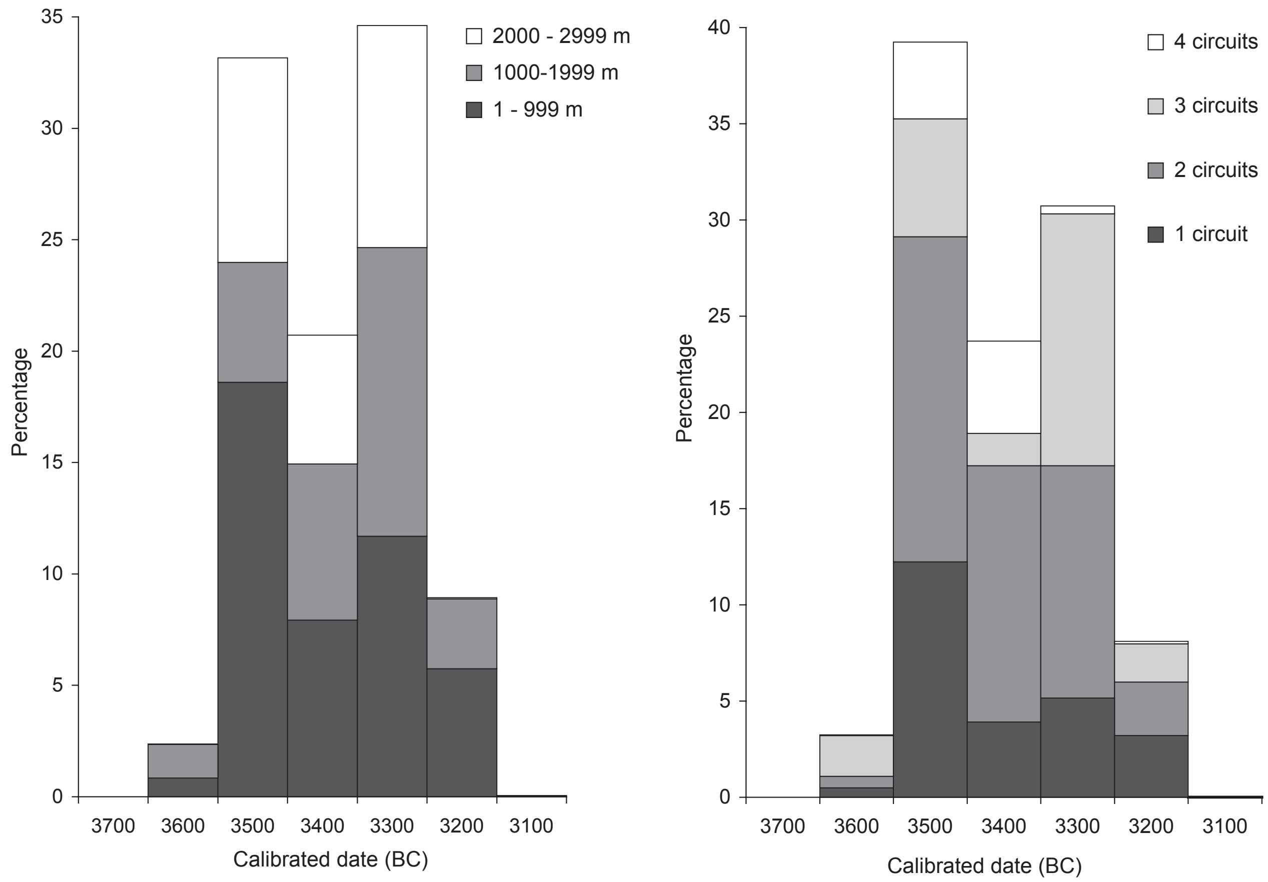


Fig. 14.31. Percentage of southern British enclosures going out of primary use by century and by (left) total ditch length (n=20) and (right) number of circuits (n=24).

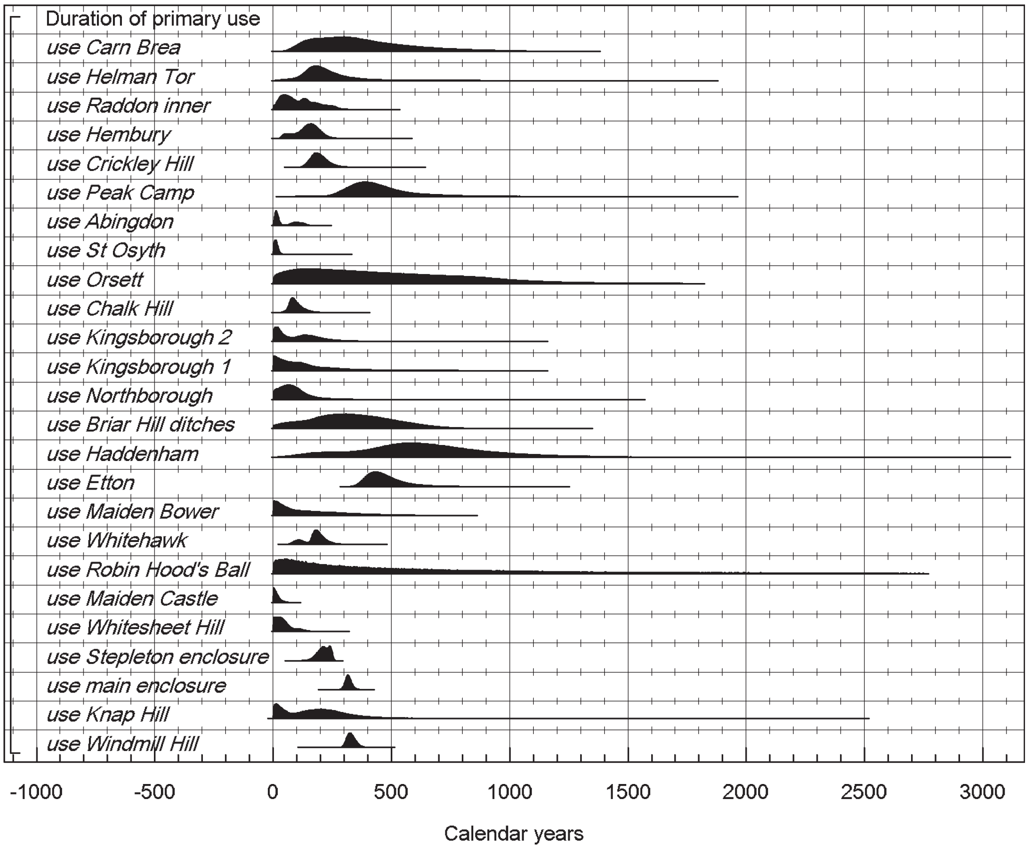


Fig. 14.32. Probability distributions for the number of years in which causewayed and related enclosures in southern Britain were in primary use, derived from the site-based models enumerated in the captions to Figs 14.2–4.

Haddenham (Fig. 6.12: *use Haddenham*) or Briar Hill (Fig. 6.23: *use Briar Hill ditches*) are extremely poorly dated, so that their apparent longevity may be spurious. The massive single-ditched enclosure at Haddenham was argued by its excavators to have been an undertaking of concentrated effort and relatively brief use (Evans and Hodder 2006a, 317). It is difficult to estimate the area of the enclosure at St Osyth, although this must have been over 5 ha, placing it among the larger sites (Oswald *et al*. 2001, fig. 4.23). That was probably of extremely brief duration (*less than 25 years at 91% probability*). Other large and complex sites are either unexcavated, like Fornham All Saints, or poorly dated, like The Trundle (Oswald *et al*. 2001, fig. 4.26). At the moment, therefore, neither size or complexity, nor a combination of the two, can be taken as reliable indicators of sites which endured. So what then was distinctive about Hambledon Hill and Windmill Hill on the one hand, and Etton on the other? This raises important questions, once again, about place and tradition. Was the maintenance of interest the same at Etton as in the Wessex examples, and was it the same in both of them? Was the cluster of enclosures around Etton equivalent to the concentration of effort and maintenance of interest in each of the two large Wessex sites?

The filling and recutting of enclosure ditches

The infilling of causewayed and related enclosure ditches would have resulted from an interplay between natural silting and human intervention, in the form of recutting, deposition and backfilling. The rate and character of natural silting would have been significantly affected by earthwork form and local topography, as well as by contemporary vegetation and land use. In the face of all these variables, it is difficult to assess rates of infill at particular monuments, especially given that some enclosure ditches may have been completely cleaned out; that deliberate backfilling may not always have been identified; that recuts, especially in loose rubble, may equally have escaped attention; and that the structure of banks and their proximity to the ditch edges can often be judged only uncertainly.

Many of the enclosure ditches considered here contained deep accumulations of the geological solid through which they were dug, sometimes occupying most of the depth of the ditch, whether chalk rubble, as at Windmill Hill (Figs 3.12–13), gravel, as at Abingdon (Fig. 8.15) or finer deposits, as in the two Kingsborough enclosures (Fig. 7.14). The Overton Down and Wareham Bog experimental earthworks, initiated in the early 1960s and subsequently excavated and recorded at fixed intervals, record the process and timescale of ditch silting on, respectively, chalk and sand (Bell *et al.* 1996). The silting of both ditches differs

from that of causewayed enclosure ditches, especially in the case of Overton Down. It is worth summarising these differences and examining reasons for them to help to determine how far the experiments are applicable to the monuments under consideration here.

The fill of the Wareham Bog ditch remained mobile and unstable after 17 years, when approximately one-third of the original depth of the ditch (0.50 m out of 1.80 m) was filled with sand (Bell *et al.* 1996, fig. 14.1). For most of this period the silting was symmetrical, material from the bank starting to enter the ditch only in the last few years. It is easy to imagine the process continuing to almost fill the ditch, producing an end result similar to those seen in the gravels of, for example, Abingdon (Fig. 8.15) or the eastern arc of Etton (Fig. 6.31: sections B and C) before recuts were made. There is reason to think, however, that the process differed at both sites from that observed at Wareham. Delayed entry of material from the bank of Wareham earthwork into the ditch reflects its original construction, with a 1 m-wide berm between bank and ditch edge and a dumped bank conforming to the angle of rest of the sand. If the upcast had been closer to the ditch, as it may have been at Etton, where short-lived spoil heaps around the segments are envisaged rather than a regular, longer-lasting internal bank (Pryor 1998, 69; French 1998c, 320), it could have begun to enter the ditch sooner. In some segments in the east of the circuit, infill would have been accelerated by deliberate and repeated backfilling which often occupied between half and two-thirds of the ditch (French 1998c, 319–20; Pryor 1998, 68, 311). The completeness of turves in the phase 1A backfill of the eastern arc indicated that they had not been on the surface beside the ditch for more than a few years and probably less (French 1998c, 312, 315; Pryor 1998, 357).

At Abingdon the fills of both ditches were asymmetric from the first (Fig. 8.15), indicating little space between the bank, probably of simple dump construction, and the ditch, leading to the kind of silting effectively summarised in Avery's diagram (1982, fig. 9). Input from the bank from an early stage would surely have accelerated the process. In the outer ditch, block-like elements in dark, loamy layers derived from the interior near the base of the section (Fig. 8.15, lower) were seen as remnants of a collapsed turf revetment (Case 1956, 14). If so, there could have been an abrupt and massive inrush of gravel into the ditch, although there is the alternative possibility that the loamy layers were turves from the ditch edge, falling as it weathered back. In either case, infilling would have been rapid, since, if the loam bands have any seasonality, they suggest that over a metre of fill accumulated over only a few years.

The Tertiary and Drift deposits of Kingsborough are also mobile and unstable. The asymmetry of the fills of the inner ditch of Kingsborough 1 suggests a nearby inner bank and consequently accelerated infilling (Fig. 7.14: section A). Repeated slumping in the Kingsborough 2 fills (M. Allen *et al.* 2008, 242–4) is equally suggestive of rapid initial infill.

In all these cases, Wareham's one-third of depth in 17 years could, on the face of it, be an underestimate of the rate of infilling. To some extent this can be tested against the dating achieved in this project, especially when it comes to the first stage of apparently rapid, primary filling, derived from the ditch sides, with or without a contribution from the bank. The number of relevant enclosures is restricted because the upper or final parts of these fills have furnished samples suitable for dating less often than their lower parts. At Kingsborough 2, for example, all the datable samples (apart from a second millennium cal BC one from the top of the sequence) came from near the base of the primary fills (M. Allen *et al*. 2008, fig. 6).

At Abingdon, where there is no obvious sign of cleaning out or recutting until all the primary fills had accumulated, the estimates for both ditches are affected by the bimodality of all the dates from this monument (Figs 8.19–21). They are, however, compatible with a Wareham-like timescale: *0–35 years* (*95% probability*; Fig. 8.23: *recut B/inner*), probably *a decade* (*68% probability*) for the inner ditch in Trench B; *0–30 years* (*95% probability*; Fig. 8.23: *recut C/inner*), probably *0–15 years* (*68% probability*), for the inner ditch in Trench C; and *0–30 years* (*57% probability*; Fig. 8.23: *fill Abingdon outer*) or *45–125 years* (*38% probability*), probably *0−25 years* (*55% probability*) or *70−95 years* (*13% probability*) for the outer ditch.

At Kingsborough 1 the dates obtained span the primary fills, which occupy approximately one-third of the middle ditch (M. Allen *et al*. 2008, figs 3–4). They indicate accumulation over *0−285 years* (*95% probability*; Table 14.2; distribution not shown), probably over *0–130 years* (*68% probability*). This distribution is heavily skewed towards a shorter period of filling. This estimate could be compatible with the short duration of infill suggested by the Wareham experimental earthwork, the tail of the distribution towards a longer period of infill being a product of the small number of dates available. A slightly longer duration may be due to the partial cleaning out of the ditch while the primary fills were accumulating, visible in the truncation of contexts 2530, 2532 and 2533 (Fig. 7.14: section A). There is the impression that the middle ditch at Kingsborough 1 was maintained for a period then left to silt.

This effect is even more marked in the eastern arc at Etton, where repeated recutting and backfilling in the course of the extended use of the monument led to an interval of *165–250 years* (*14% probability*; Table 14.2; distribution not shown) or *280–510 years* (*81% probability*), probably *195−215 years* (*3% probability*) or *290−405 years* (*65% probability*) between the construction of the monument and the final phase 1C recut in its infilled ditch. Since the ditch was already largely infilled when the 1C recuts were made (Fig. 6.30: section B; Pryor 1998, figs 73–4), this interval may incorporate a period of stability before they were made. At Briar Hill equally numerous and complex recuts (Bamford 1985, figs 6–17) would be compatible with a similarly long span, although the potentially centuries-long duration of the site can be estimated only imprecisely (Chapter 6.3.1).

It is more often possible to date the accumulation of

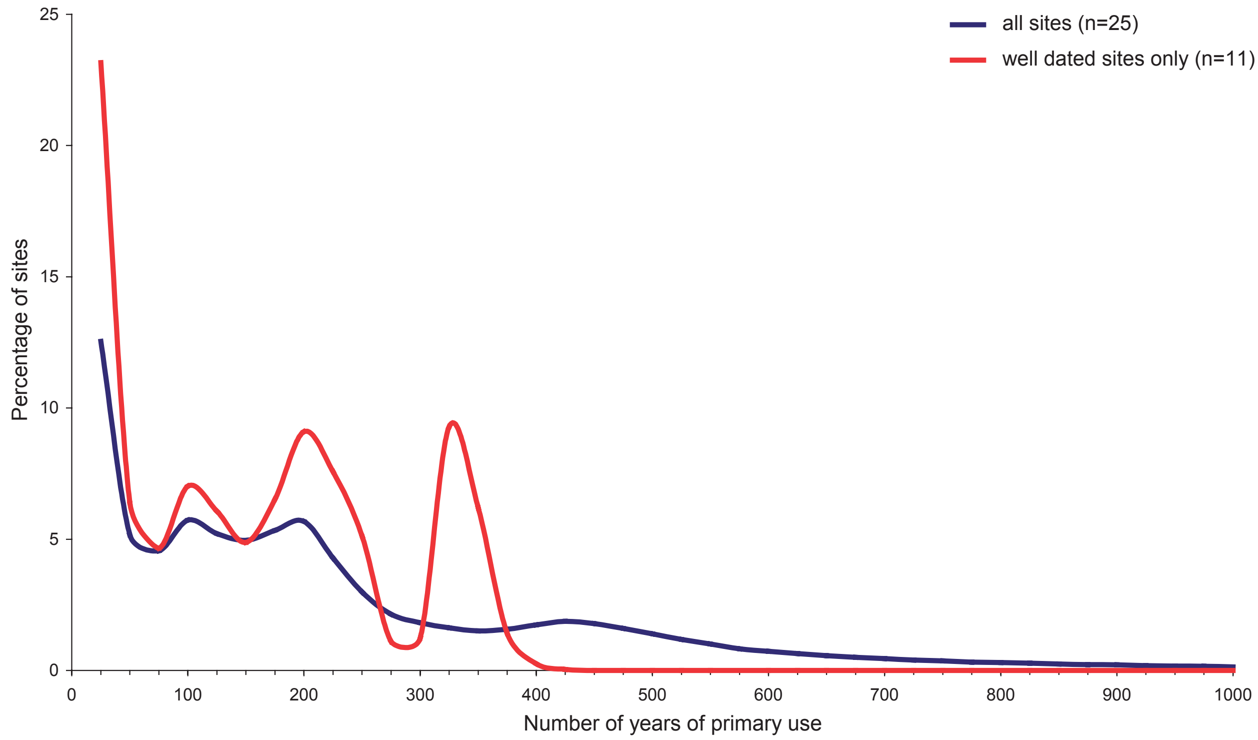


Fig. 14.33. Proportion of southern British enclosures which were used for different lengths of time (by 25-year period).

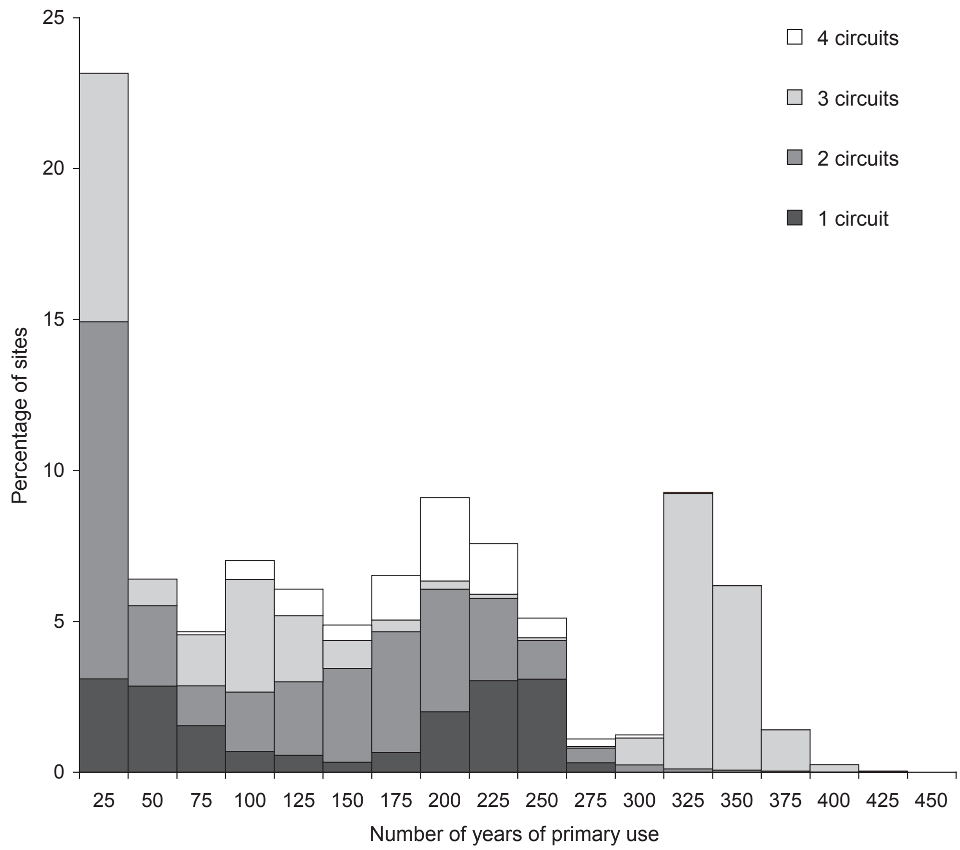


Fig. 14.34. Proportion of southern British enclosures which were used for different lengths of time (by 25-year period, and by number of circuits (n=11)).

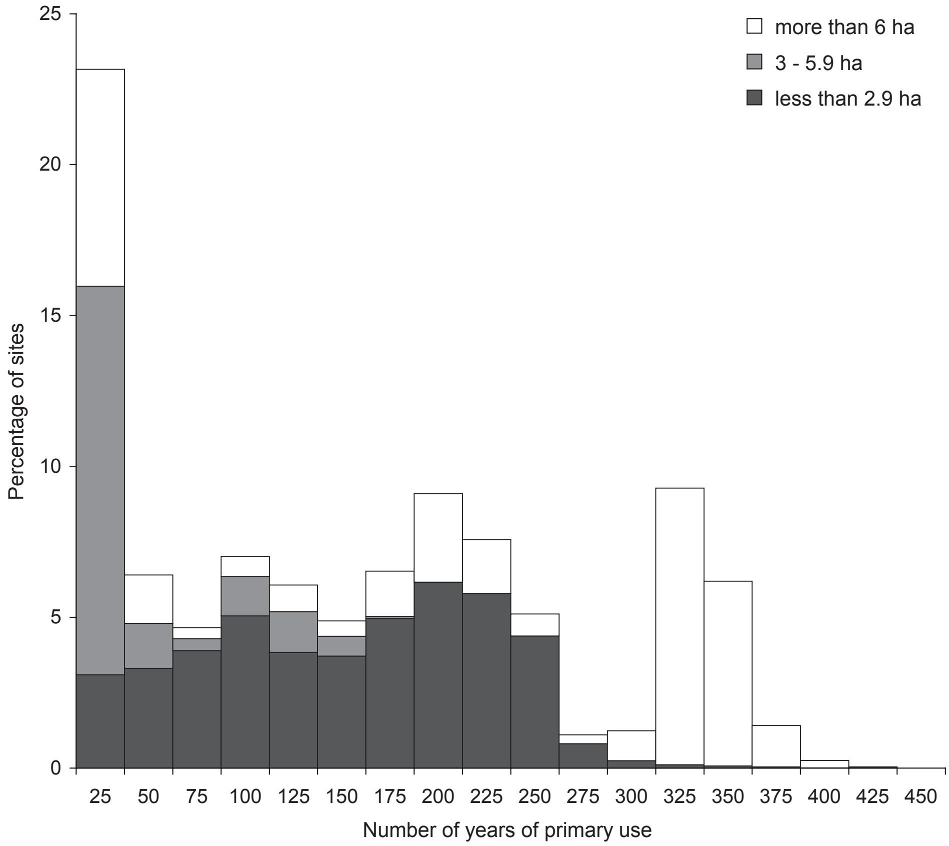


Fig. 14.35. Proportion of southern British enclosures which were used for different lengths of time (by 25-year period, and by estimated total area (n=11)).

primary fills on chalkland sites. Here, morphological and topographical dissimilarities between the Overton Down experimental earthwork and causewayed enclosure ditches are substantial.

1. The Overton Down earthwork was built on virtually level ground, while almost all the chalkland causewayed enclosures are on slopes, where infill could be accelerated by gravity.
2. Once the Overton earthwork was built, its builders went away, leaving it in undisturbed grassland, which colonised and stabilised both bank and ditch fill within about 15 years (Bell *et al.* 1996, fig. 14.2). An earthwork built in woodland, as many chalkland enclosures seem to have been, would not be surrounded by such a continuous matt of vegetation, leaving the bank and the ditch edges more prone to erosion and to disturbance in the course of subsequent visits, especially as livestock were periodically present.
3. This rapid colonisation of the Overton Down earthwork by grasses and herbs, combined with the earthwork's 1 m-wide berm, ensured that only a minimal amount of bank material entered the ditch before its symmetrical fills were stabilised, while the markedly asymmetric fills of some chalkland enclosures make it clear that bank material entered their ditches in some quantities (e.g. Figs 3.13, 3.23, 4.50).
4. The proportions of the experimental earthworks correspond roughly to those of enclosures built on mobile geologies, but less so to chalk-cut ones. The Overton Down ditch was dug with a depth:width ratio of approximately 1:1.5 which had weathered to 1:2.5 after some 30 years (Bell *et al*. 1996, fig 14.2). To take Hambledon as an example, the equivalent ratios for the extensively excavated ditches, where large numbers of sections should provide representative proportions, range from 1:1.7 for the Stepleton enclosure to 1:3.1 for the outer Stepleton outwork, with a mean of 1:2.4 (Mercer and Healy 2008, 747). If the Hambledon ditches were proportionately narrower after more than five millennia of weathering than the Overton Down one was after three decades, then their proportions would have been much narrower than Overton's when they were first dug. In consequence, the erosion of their sides will have filled the lower parts of the ditches more rapidly than the same process has at Overton. The profiles of other chalk-cut enclosure ditches suggest that they were originally of similar proportions.
5. There is occasionally evidence for timber bank structures, perhaps box frame ramparts, so that, as with the possible turf revetment of the outer bank at Abingdon, once these gave way or were destroyed, masses of bank material could enter ditches in a single event (having perhaps impeded natural fill processes up till then).

Table 14.2. Estimates of the period of primary infill from selected causewayed enclosure ditches.

Site and ditch	**Earlier parameter**	**Later parameter**	**Duration of infill**	***Posterior density estimate* (*probability in years*)**	**Geology**
Abingdon inner	*build Abingdon inner* (Fig. 8.18)	*area B recut* (Fig. 8.19)	*recut B/inner* (Fig. 8.23)	*0–35 years* (*95%*); *0–10 years* (*68%*)	Gravel
Abingdon inner	*build Abingdon inner* (Fig. 8.18)	*area C recut* (Fig. 8.20)	*recut C/inner* (Fig. 8.23)	*0–30 years* (*95%*); *0–15 years* (*68%*)	Gravel
Abingdon outer	*build Abingdon outer* (Fig. 8.21)	*end Abingdon outer* (Fig. 8.21)	*fill Abingdon outer* (Fig. 8.23)	*0–30 years* (*57%*) or *45–125 years* (*38%*); *0–25 years* (*55%*) or *70–95 years* (*13%*)	Gravel
Crickley continuous ditch	*UB-6397* (Fig. 9.10)	*UB-6396* (Fig. 9.10)	*fill Crickley continuous* (distribution not shown)	*10–125 years* (*95%*); *15–75 years* (*68%*)	Limestone
Etton	*build Etton* (Fig. 6.33)	*GrA-29354* (Fig. 6.33)	*fill Etton* (distribution not shown)	*165–250 years* (*14%*) or *280–510 years* (*81%*); *195–215 years* (*3%*) or *290–405 years* (*65%*)	Gravel
Hambledon main enclosure	*build main enclosure* (Fig. 4.14)	*HH76 1354* (Fig. 4.9)	*Hambledon main I fill* (distribution not shown)	*120–255 years* (*95%*); *135–225 years* (*68%*)	Chalk
Hambledon main enclosure	*HH76 1354* (Fig. 4.9)	*OxA-7017* (Fig. 4.9)	*Hambledon main V fill* (distribution not shown)	*0–140 years* (*95%*); *20–115 years* (*68%*)	Chalk
Hambledon Stepleton enclosure	*build Stepleton enclosure* (Fig. 4.11)	*ST80 1156* (Fig. 4.11)	*Stepleton first fill* (distribution not shown)	*85–195 years* (*95%*); *105–165 years* (*68%*)	Chalk
Knap Hill	*build Knap Hill* (Fig. 3.20)	*OxA-15305* (Fig. 3.20)	*Knap Hill fill* (distribution not shown)	*0–215 years* (*95%*); *0–110 years* (*68%*)	Chalk
Maiden Castle inner ditch	*dig Maiden inner* (Fig. 4.42)	*GrA-29109* (Fig. 4.42).	*Maiden Castle inner fill* (distribution not shown)	*0–30 years* (*95%*); *0–20 years* (*68%*)	Chalk
Whitehawk ditch II	*dig Whitehawk II* (Fig. 5.7)	*R4100/143/W* (Fig. 5.7)	*Whitehawk II fill* (distribution not shown)	*0–140 years* (*95%*); *5–30 years* (*16%*) or *70–125 years* (*52%*)	Chalk
Whitehawk ditch III	*dig Whitehawk III* (Fig. 5.8)	*OxA-14144* (Fig. 5.8)	*Whitehawk III fill* (distribution not shown)	*1–115 years* (*95%*); *40–100 years* (*68%*)	Chalk
Whitehawk ditch I	*Dig Whitehawk I* (Fig. 5.6)	*OxA-14030* (Fig. 5.6)	*Whitehawk I fill* (distribution not shown)	*0–100 years* (*95%*); *20–85 years* (*68%*)	Chalk

Site and ditch	Earlier parameter	Later parameter	Duration of infill	*Posterior density estimate (probability in years)*	Geology
Whitesheet Hill	*build Whitesheet Hill* (Fig. 4.26)	*GrA-30067* (Fig. 4.26)	*Whitesheet Hill fill* (distribution not shown)	*0–115 years* (*95%*); *0–55 years* (*68%*)	Chalk
Windmill inner ditch	*dig WH inner* (Fig. 3.9)	*GrA-25560* (Fig. 3.9)	*inner WH fill* (distribution not shown)	*165–190 years* (*3%*) or *275–355 years* (*92%*); *290–330 years* (*68%*)	Chalk
Windmill middle ditch	*dig WH middle* (Fig. 3.10)	*OxA-13714* (Fig. 3.10)	*middle WH fill* (distribution not shown)	*25–140 years* (*72%*) or *175–250 years* (*23%*); *45–130 years* (*61%*) or *200–225 years* (*7%*)	Chalk
Kingsborough 1 middle ditch	*start Kingsborough 1* (Fig. 7.15)	*GrA-29553* (Fig. 7.15)	*Kingsborough 1 fill* (distribution not shown)	*0–285 years* (*95%*); *1–130 years* (*68%*)	Drift deposits

These considerations go a long way to explain why the fill pattern of the Overton Down earthwork differs from those of most chalkland enclosure ditches. That fill pattern can be summarised as follows. Almost all of the 1.20 m of chalk rubble fill which occupied the ditch sides after 30 years (Bell *et al.* 1996, fig. 7.5) had already been in place two years after construction (Bell *et al.* 1996, fig. 14.2); virtually no rubble had accumulated on the centre of the ditch floor (almost certainly a product of the depth: width ratio); and after 20 years vegetation had spread over bank and ditch and a soil had begun to form (Bell *et al.* 1996, fig. 14.2). If current conditions persist, the present V-profile, with only some 0.10 m of fill on the centre-base of the ditch, could persist indefinitely.

In most chalkland causewayed enclosure ditches, rubble spanned the full width, rather than being concentrated at the sides, and, even at the centre, often occupied half or more of the surviving depth. This can be attributed to a less rapidly formed and less stabilising vegetation cover; to narrower proportions, seen strikingly in the 1.75 m of undifferentiated chalk rubble in the particularly deep and narrow ditch of Whitesheet Hill (Fig. 4.24); to the proximity and potential instability of banks, often accentuated by slope; and, at least in some cases, to repeated frequentation of the monuments.

The dating again provides information for those sites where there are sequences bracketing the rubble fills (Table 14.2). At Whitesheet Hill, the estimate for the accumulation of chalk rubble is *0–115 years* (*95% probability*; distribution not shown), probably *0–55 years* (*68% probability*), with the distribution heavily skewed towards a shorter period of infill. At Knap Hill, where there is similarly no sign of intervention in the rubble fills, the estimate is less precise – *0−215 years* (*95% probability*; distribution not shown), probably *0−110 years* (*68% probability*) – but could be comparably short as the distribution is strongly skewed towards a shorter duration. The shortest rubble accumulation was in the inner ditch at Maiden Castle, where the interval from the digging of the ditch to the deposition of the lowest 'midden' layer can be estimated as *0−30 years* (*95% probability*; distribution not shown), probably *0−20 years* (*68% probability*). It should be noted, as discussed in Chapter 4 and further below, that this layer at Maiden Castle may have been associated with the burning and collapse of the bank, which would have infilled the ditch faster than natural accumulation.

Relatively imprecise estimates for ditches I, II and III at Whitehawk and for the limestone rubble of the continuous ditch on Crickley Hill are of the same order as that for Knap Hill (Table 14.2). The exceptions are for the middle and inner ditches of Windmill Hill and for the main and Stepleton enclosures on Hambledon Hill. Estimates of the duration of primary filling in all four are surprisingly extended, at least a century and quite probably longer. This is implausible in the light of the considerations outlined above and of the estimates for other sites.

There is one obvious explanation, that the samples chosen to date the end of the accumulation of chalk rubble

may have lain on stable surfaces, so that they could have significantly post-dated the underlying rubble deposits. They were *GrA-25560*, measured on an articulated bone sample from a bone deposit on the surface of the chalk rubble fill in the inner ditch of Windmill Hill (Fig. 3.12, lower: context 630); *OxA-13714*, measured on a rib from a 'bundle' in a bone deposit in a humic layer overlying the top of the chalk rubble in the middle ditch of Windmill Hill (Fig. 3.13, upper: context 411); *HH76 1354*, the mean of two measurements on articulating deer phalanges from an apparently dumped deposit overlying the top of the chalk rubble in the main enclosure on Hambledon Hill (Mercer and Healy 2008, fig. 3.29: layer 9a); and *ST80 1156*, the mean of two measurements on an articulated dog skeleton lying on the topmost, rather silty and comminuted, layer of chalk rubble fill (Mercer and Healy 2008, fig. 3.85: section D–D', interface of layers 3B and 2). Yet the upper limits of the Whitehawk estimates were similarly provided by dates from contexts succeeding the rubble fills, and these durations are much shorter. As at Etton, the extended durations at Hambledon and Windmill Hill probably reflect extended maintenance, with or without periods of stability and diminished intervention, undertaken before all the surviving primary fills accumulated. At Hambledon, the sections cited above show that rubble was removed from the two segments in question at least once, the ditch being cleared almost to the base, echoing the treatment of the inner ditch of Kingsborough 1. Cuts in chalk rubble are notoriously difficult to identify, and may be under-represented in the archaeological record, unlike interventions in the secondary silts of ditches, which are easier to recognise.

The main enclosure at Hambledon also provides a rare opportunity to estimate the rate of accumulation of secondary silts (e.g. Fig. 4.3, upper: layers 5, 5a, 5b). This much slower process seems to have been completely natural here; it can be estimated that approximately 0.30 m of secondary silt accumulated over *0–140 years* (*95% probability*; Table 14.2; distribution not shown), probably *20–115 years* (*68% probability*).

The intensity of deposition at enclosures

There is great variability in the density and composition of cultural material between the circuits of the same enclosure, as at Kingsborough 1 (M. Allen *et al.* 2008), Chalk Hill (Chapter 7), Maiden Castle (Sharples 1991a) or Windmill Hill (Whittle *et al*. 1999, figs 222–6). Variability in artefact density between monuments and between regions has also been demonstrated (C. Evans *et al.* 2006, table 12; Mercer 2006a, table 5.1). Both analyses, though conducted by different methods, suggest a gradient from generally low levels of deposition in the east (Great Wilbraham proving a signal exception) to higher ones in the Thames valley and yet higher ones in Wessex and, in Mercer's analysis, the south-west peninsula.

It is now possible to examine how far that pattern is a product of the varying durations of different sites as distinct from the behaviour of their users, and how far the material itself reflects the intensity of use of individual sites. To do this it is necessary to relate the estimated period of the primary use of a monument (the parameters assembled in Fig. 14.32) to estimates of the total amount of material deposited during that use (summarised in Tables 14.3–4). This is possible only for sites where a reasonably precise estimate of the duration of primary use is available; where the finds are contexted and quantified; and where the original extent of the monument can be estimated. Several of the sites employed by previous authors, including Haddenham, Great Wilbraham, Briar Hill, Orsett, Staines and Offham Hill, do not meet these criteria, especially the need for a relatively precise and robust estimate of duration.

A second major difference between this exercise and those of previous authors, in addition to spreading the assemblages over time, is that it employs only material from early Neolithic contexts (in the sixth and tenth columns of Table 14.3). This must have been deposited during the primary use of each site. In some cases there are major differences between these subtotals and the overall ones, as in the lithics from Windmill Hill and Chalk Hill, where there was substantial third and second millennium cal BC activity (Table 14.3). The results also differ from those presented for Hambledon Hill by Mercer and Healy (2008, table 11.4), since this deals with material from all contexts in all earthworks.

The exercise here is confined to Neolithic Bowl pottery and struck flint and chert, since these survive on all geologies. The excavated sample of each site was used to estimate the total assemblages. For ditches, the total length was estimated and the total assemblage extrapolated from the percentage of that length excavated. For other contexts, the total enclosed area was estimated and the total assemblage extrapolated from the percentage of the area excavated (Table 14.3). The results are necessarily approximate. The possibility that they are unreliable rises where only small, possibly unrepresentative, proportions of a site have been excavated (as indicated in the second column of Table 14.3). Furthermore, recovery and retention have not been even across all the sites included in the analysis. They were probably less than total in Leeds' excavations at Abingdon; and the totals for the excavations at Windmill Hill, including discarded material, were reconstructed from the paper archive of Keiller (Whittle *et al.* 1999, 26, 333). While sieving of one kind or another will have been practised in most recent excavations, it is generally difficult to determine its nature and extent. This is particularly significant for lithics, since the more sieving and flotation there are, the more microdebitage (chips with a maximum dimension <10 mm) will be recovered. In the two cases where chips have been separately quantified (Chalk Hill and Whitesheet Hill), they have been excluded from the totals, on the grounds that they were probably more fully recovered at these two sites than elsewhere.

For each site in Table 14.3, we have calculated the number of struck lithics and the number of Bowl pottery

Table 14.3. Excavated and estimated totals of Neolithic Bowl pottery and struck flint and chert from selected enclosures.

Site	**% excavated**	**No. of Bowl sherds from all contexts**		**No. of Bowl sherds from early Neolithic contexts**		**No. of pieces of struck flint and chert from all contexts**		**No. of pieces of struck flint and chert from early Neolithic contexts**		**Notes**
		Excavated	Estimated	Excavated	Estimated	Excavated	Estimated	Excavated	Estimated	
Eastern England										
Etton	Ditch 60% other 51%	2196	3785	1772	3785	6284	11798	1909	3580	Flint numbers from Middleton (1998). Sherd numbers approximate, calculated from information supplied by K. Gdaniec and M. Knight
Kingsborough 2	Ditch 18% other 60%	1141	5406	876	4827	143	549	57	317	From M. Allen *et al.* (2008)
Chalk Hill	Inner ditch 30% middle ditch 30% outer ditch 10%; other 22%	1228	7302	1210	7220	15003	68195	6675	30341	From Shand (2001); Gibson (2002a); Wilson (2002)
Thames valley										
Abingdon totals	Inner ditch 35% outer ditch 1% other 4%	5504	25914	5504	25914	5257	25100	4935	17050	From Case (1956); Case and Whittle (1982). Sherds numbers calculated on mean sherd weight of 7.5 g (C. Evans *et al.* 2006, 151) from weights given in publications. All finds from the ditch are taken as from early Neolithic contexts since there was very little later material in the ditch tops. Recovery and/or retention of finds are unlikely to have been complete in Leeds' excavations
Wessex										
Hambledon main enclosure	Ditch 18% other 14%	11052	69286	8754	54671	18090	111992	9254	56575	From Mercer and Healy (2008). Includes enclosure ditch and pits and other contexts within enclosure, excludes cross-dykes, south long barrow and western outwork
Hambledon Stepleton enclosure	Ditch 45% other 78%	9284	17019	7665	13719	12857	22263	7347	13962	From Mercer and Healy (2008).). Includes enclosure ditch and pits and other contexts within enclosure, excludes outworks
Whitesheet Hill	Ditch 1% other 1%	625	62500	611	61100	15972	1597200	15200	1520000	From Rawlings *et al.* (2004). Finds from the Piggott and Stone excavation are excluded because they are not quantified in the publication. Chips (flakes and fragments with a maximum dimension <10 mm) are excluded from the totals of struck flint and chert because, due to extensive sieving of pit contents, they amount to 23% of the material from non-ditch contexts and would reduce the comparability of the totals with those from other sites where chips were recovered on a far smaller scale or not at all
Maiden Castle	Inner ditch 1% Outer ditch 0.8% Other 2%	789	78950	789	78860	21437	765607	8127	290250	From Sharples (1991a). The larger assemblage from Wheeler's more extensive excavations has not been used because not all of it was available for quantification in the 1980s (e.g. Cleal 1991, 171)

Site	% excavated	No. of Bowl sherds from all contexts		No. of Bowl sherds from early Neolithic contexts		No. of pieces of struck flint and chert from all contexts		No. of pieces of struck flint and chert from early Neolithic contexts		Notes
		Excavated	Estimated	Excavated	Estimated	Excavated	Estimated	Excavated	Estimated	
Windmill Hill	Inner ditch 85% Middle ditch 30% Outer ditch 10% Other 2%	20814	83803	10357	62774	99889	443617	14681	110552	From Whittle *et al.* (1999, tables 1–51, 172–92). The totals of pottery from all contexts and of pottery and lithics from early Neolithic contexts in the Keiller and Smith excavations are taken from tables 1–51. Those of lithics from all contexts in the same excavations are taken from tables 191–2. Some quantities are approximate. Partly because they are derived from paper records of discarded artefacts (I. Smith 1965a, 29–30; Whittle *et al.* 1999, 333) The limits of early Neolithic ditch fills have been approximated from pottery and radiocarbon dates, or, failing these, by analogy with other segments
Knap Hill	Ditch 3% Other 2%	15	650	6	267	2786	112433	1346	49183	From Connah (1965). The material from the Cunningtons' earlier excavations is not included

sherds deposited per year of the primary use of the enclosure. This has been done by calculating the probability that it was in use for each 25-year band, multiplying this by the estimated total of struck lithics or Bowl pottery sherds from early Neolithic contexts (Table 14.3), and dividing this by the higher number of years limiting the band in question. The totals for each 25-year band of the duration of the use of the site are then added, to provide an estimate of the number of sherds or lithics deposited in each year of its use. For example, it is *79% probable* that Maiden Castle was in use for 0–25 years; we estimate that a total of 78,860 Bowl sherds were deposited during the primary use of this site. In the first 25 years of the use of Maiden Castle, 62,378 sherds (0.791 x 78,860) would have been deposited – 2,495 sherds per year (62,378 ÷ 25). The totals from similar calculations for the bands covering a duration of 26–50 years, 51–75 years, and so on, are then added together to provide the estimates of the numbers of sherds or struck lithics deposited per year (see below and Table 14.3).

The introduction of time into the estimates (Table 14.4) makes the quantity of material deposited at enclosures in Wessex far less uniformly rich, although most of the higher densities still occur in the region. This is not simply a matter of the availability and the quality of Chalk flint, since it applies to pottery as well as lithics, and both Hambledon enclosures have quite low frequencies of lithics.

It also demonstrates relatively high annual rates of deposition at the short-lived monuments of Abingdon and Maiden Castle. The result for Abingdon, of 666 Bowl sherds and 438 lithics per year, is probably representative, in that a substantial portion of the inner ditch was excavated, and may, if anything, be an underestimate, since in this, the oldest of the excavations used in the analysis, recovery and retention may not have been complete. The overall result for Maiden Castle, of 2806 Bowl sherds and 10,329 lithics per year, might seem questionable, in that the finds are quantified from only a very low proportion of the enclosure (Table 14.3). But there is reason to accept it because, although incomplete, the assemblage from Wheeler's more extensive excavations shows every sign of having been equally abundant. Although the artefacts from Wheeler's excavations were not quantified in the original report and are not all extant, the remnant of the Neolithic material reported by Cleal (1991) and Edmonds and Bellamy (1991) is so substantial as to be compatible with the densities estimated here from the Sharples material. Rims from 338 Neolithic Bowls survive from the Wheeler excavations, for example, alongside a total of 105 from 1985–6 (Cleal 1991, tables 132–3, microfiche).

Given only limited excavation, it is difficult to judge whether the high ceramic and lithic densities from Whitesheet Hill and the high lithic density from Knap Hill are to be taken at face value. The high Whitesheet densities are largely derived from a few prolific pits (Fig. 4.23), which may or may not be representative of the interior as a whole. At Knap Hill, the high lithic densities spring mainly from a dense knapping cluster encountered in one out of

Table 14.4. Quantities of Neolithic Bowl pottery and struck flint and chert deposited per year, based on the estimates in Table 14.3.

Site	***Posterior density estimate*** **(Fig. 14.32)**	**Bowl sherds per year (early Neolithic contexts only)**	**Lithics per year (early Neolithic contexts only)**	**No. of pieces of struck flint per Bowl sherd per year (early Neolithic contexts only)**
Eastern England				
Etton	*use Etton* *345–635 years* (*95% probability*; *380–510 years* (*68% probability*)	8	8	1.0
Kingsborough 2	*use Kingsborough 2* *0–315 years* (*95% probability*); *0–65 years* (*38% probability*) or *100–185 years* (*30% probability*)	74	5	0.1
Chalk Hill	*use Chalk Hill* *45–165 years* (*95% probability*); *65–115 years* (*68% probability*)	70	294	4.2
Thames valley				
Abingdon	*use Abingdon* *0–40 years* (*57% probability*) or *65–145 years* (*38% probability*); *0–30 years* (*54% probability*) or *85–110 years* (*14% probability*)	666	438	0.7
Wessex				
Hambledon main enclosure	*use main enclosure* *290–350 years* (*95% probability*); *300–335 years* (*68% probability*)	166	171	1.0
Hambledon Stepleton enclosure	*use Stepleton enclosure* *165–255 years* (*95% probability*); *195–250 years* (*68% probability*)	62	63	1.0
Whitesheet Hill	*use Whitesheet Hill* *1–125 years* (*95% probability*); *1–55 years* (*68% probability*)	1445	35938	24.9
Maiden Castle	*use Maiden Castle* *1–50 years* (*95% probability*); *1–20 years* (*68% probability*)	2806	10329	3.7
Windmill Hill	*use Windmill Hill* *180–200 years* (*1% probability*) or *290–390 years* (*94% probability*); *305–350 years* (*68% probability*)	188	331	1.8
Knap Hill	*use Knap Hill* *1–460 years* (*95% probability*); *1–65 years* (*23% probability*) or *115–280 years* (*45% probability*)	3	482	160.7

four narrow sections across the ditch (Connah 1965, fig. 2, table I). Again, it is difficult to tell how representative these are of the whole, although Maud Cunnington's discovery of clusters of 'flint chips' in her excavations of 1908–9 (Cunnington 1912, 61) suggests that Connah's concentration was not the only one.

Variable densities of lithics in part reflect an extra-domestic aspect to the industries of some enclosures. Maiden Castle is seen as a local focus of axehead production (Edmonds and Bellamy 1991, 227–8), and the industry of Offham Hill (excluded here for want of an estimate for the duration of its primary use) had an overall sherds:lithics ratio of 1:40 and an 'industrial' character in the sense of high frequencies of cortical flakes and low frequencies of cores and retouched pieces, with the connotation that cores may have been prepared on the site and removed elsewhere (James 1977). An industrial facies at Knap Hill is strongly suggested by the massive preponderance of primary over secondary flakes (Connah 1965, table I), even if Connah used the term 'primary' to include any flake with some dorsal cortex, as the absence of tertiary flakes from his totals suggests. Cortical flakes were, by contrast, rare at Whitesheet (unpublished data).

Leaving aside the exceptional quantities of lithics deposited at Maiden Castle and Whitesheet Hill, the estimated annual totals for the other sites amount to no more than the contents of one relatively artefact-rich pit. Even disregarding exceptionally large and rich pits like the Coneybury Anomaly (J. Richards 1990, 46, 213), single early to mid-fourth millennium cal BC pits, whether within enclosures or beyond them, have yielded totals such as 290 sherds and 427 lithics from pit 1A F350 on the Stepleton spur of Hambledon Hill (Mercer and Healy 2008, 286), 90 sherds and 249 lithics from pit 1096 at Middle Farm, Dorchester, Dorset (Butterworth and Gibson 2004, 15), and 147 sherds and 207 lithics from pit 146 at Kilverstone, Norfolk (Garrow *et al.* 2006, 27).

An estimated annual assemblage that is comparable in quantity with that from a pit that could have been dug and filled in less than a day by one or two people appears disproportionate to the size of the enclosures and to the workforce needed for their construction (see above). It is often clear, however, that deposition was not spread evenly over time. It was concentrated towards the end of primary use in the recuts in the inner ditch at Abingdon, the 'midden' layers of the inner ditch at Maiden Castle, the phase 1B and 1C deposits at Etton, above the ditch bases at Windmill Hill, and the phase VI deposits in both Hambledon enclosures. In other words, when these enclosures were built, with numbers of people gathered to undertake that work, little was placed in their ditches. It was only later that there came a change of practice (Sharples 1991a, 253), with the burial of artefacts and food remains on a more extensive scale.

The food remains provide a clue to the human scale of these later episodes. One of the young cows which dominate the faunal remains at Hambledon would have provided some 300 kg of meat, offal and fat, yet some of the phase VI recuts in the main enclosure, which seem to have been cut and filled in single events, contained the remains of two or three such animals in a single segment (Legge 2008, 543–4, 569). This points to gatherings of hundreds – many hundreds if several such consumption events took place simultaneously. The events in question may have included the building of some of the later outworks. If such events were rare, with the sites effectively abandoned for years on end, the relatively high densities from short-lived sites would contrast less than they appear to with low densities from longer-lived ones, since the assemblages from the longer-lived sites would have been concentrated in a few large-scale events rather than spread over centuries. The woodland environments in which most Wessex and Sussex enclosures were built and used could reflect occasional frequentation by people and their animals; the more open surroundings of sites in eastern England need not point to different patterns of use, simply to location of the monuments in different parts of the landscape. In this scenario, the estimate of *0–140 years* (*95% probability*), probably *20–115 years* (*68% probability*), for the apparently natural accumulation of phase V secondary silts in the main enclosure at Hambledon (Table 14.2), could correspond to an interval between large gatherings, one in which little cultural material was deposited in contrast to the quantities of artefacts and food remains piled into the subsequent phase VI slots (Mercer and Healy 2008, 56–7).

Violence at causewayed enclosures

In some of the regional chapters, particularly those covering more westerly areas of the country, we have come across evidence at causewayed and stone-walled tor enclosures for both violent episodes that must have involved significant numbers of people and violence relating to individual people. Beyond enclosures, most cases of violence are to individuals. How does the evidence from different contexts and for different kinds of violent encounter fit together, and are there any temporal and regional trends? This evidence can now be brought together (Figs 14.36–7).

The map (Fig. 14.37) shows that less than 20 percent of the dated enclosures overall have data of this kind. Within this sample, however, there is more evidence for major violent events at enclosures in the central and western parts of southern England, where almost half the dated enclosures have been the subject of attack. Thus the partial burning of posts in the palisade behind the outer and middle ditches at Orsett (Chapter 7) appears to stand rather on its own in the east, contrasting with several similar episodes farther west. At Staines an individual from the primary fill of the outer ditch (skull B) had both healed and unhealed wounds (Chapter 8; Fig. 14.36; Schulting and Wysocki 2005, table 2).

The scale of these collective events can be impressive. The burning in period 1B on the Shroton spur on Hambledon Hill appears over a 140-m length of ditch, very soon after the earthwork was built. A later episode of burning in period 2 in the inner Stepleton outwork can be traced over

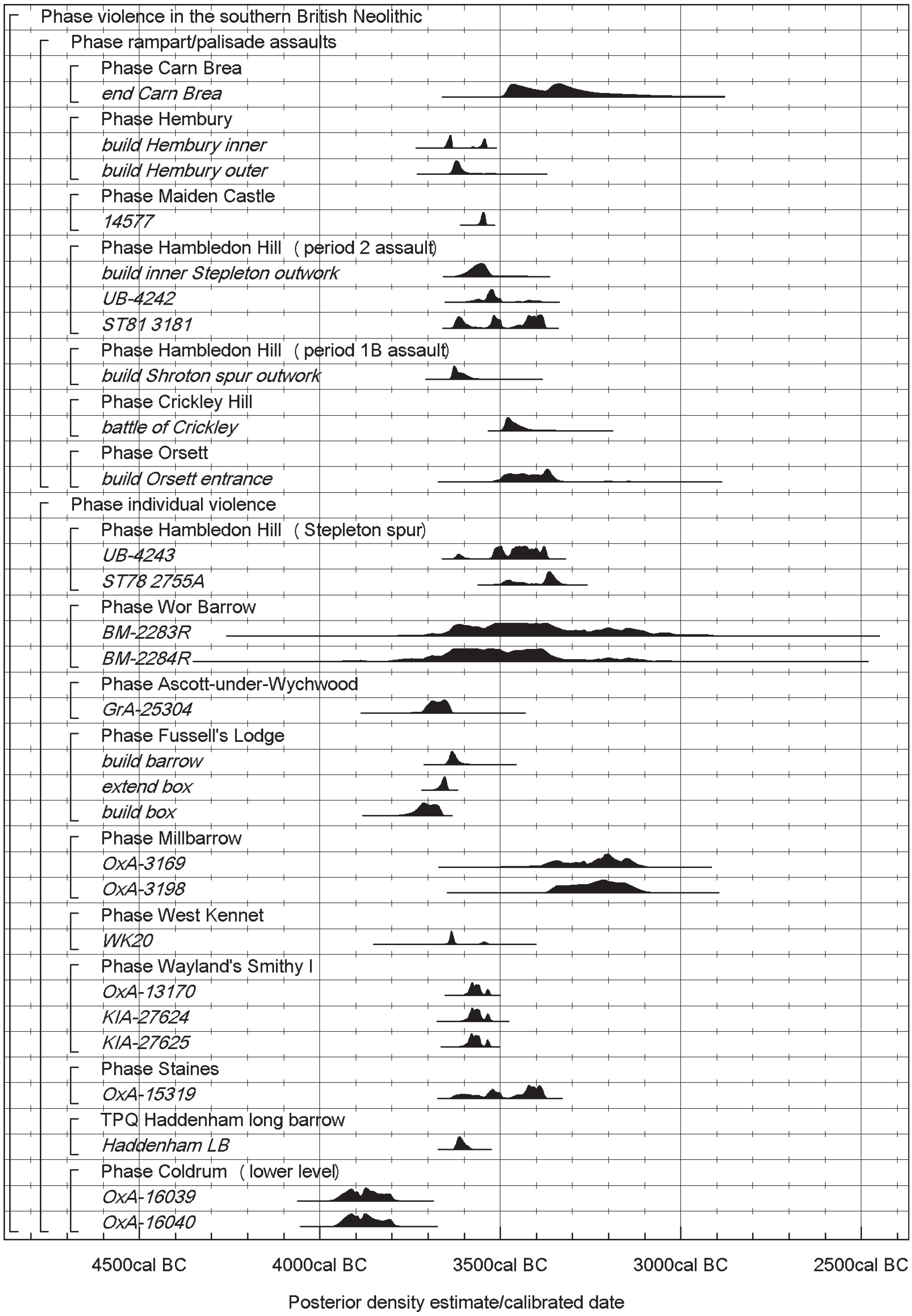


Fig. 14.36. Posterior density estimates for the dates of violent episodes in the early Neolithic of southern Britain. Distributions are derived from the site-based models enumerated in the captions to Figs 14.2–4, and additionally Bayliss et al. *(2007b, fig. 6) (West Kennet), Bayliss* et al. *(2007c, figs 3 and 5–7) (Ascott-under-Wychwood), Wysocki* et al. *(2007, fig. 10) (Fussell's Lodge), Figs 3.29–31 (Millbarrow), Whittle* et al. *(2007b, fig. 4) (Wayland's Smithy I), Figs 6.16–17 (Haddenham long barrow) and Fig. 7.27 (Coldrum).*

a 200-m length of ditch. This also occurred soon after the construction of the earthwork, as the burning was on the base of the ditch or over only a tiny amount of primary silting, and the earthwork appears to be unfinished. In both these cases, the burning appears to have destroyed a box-frame rampart constructed from oak uprights and hazel cladding, probably in the form of wattle panels or hurdles (Mercer and Healy 2008, fig. 3.99). Given the demonstrably short period between the construction of these earthworks and their burning, the question of whether they were built in

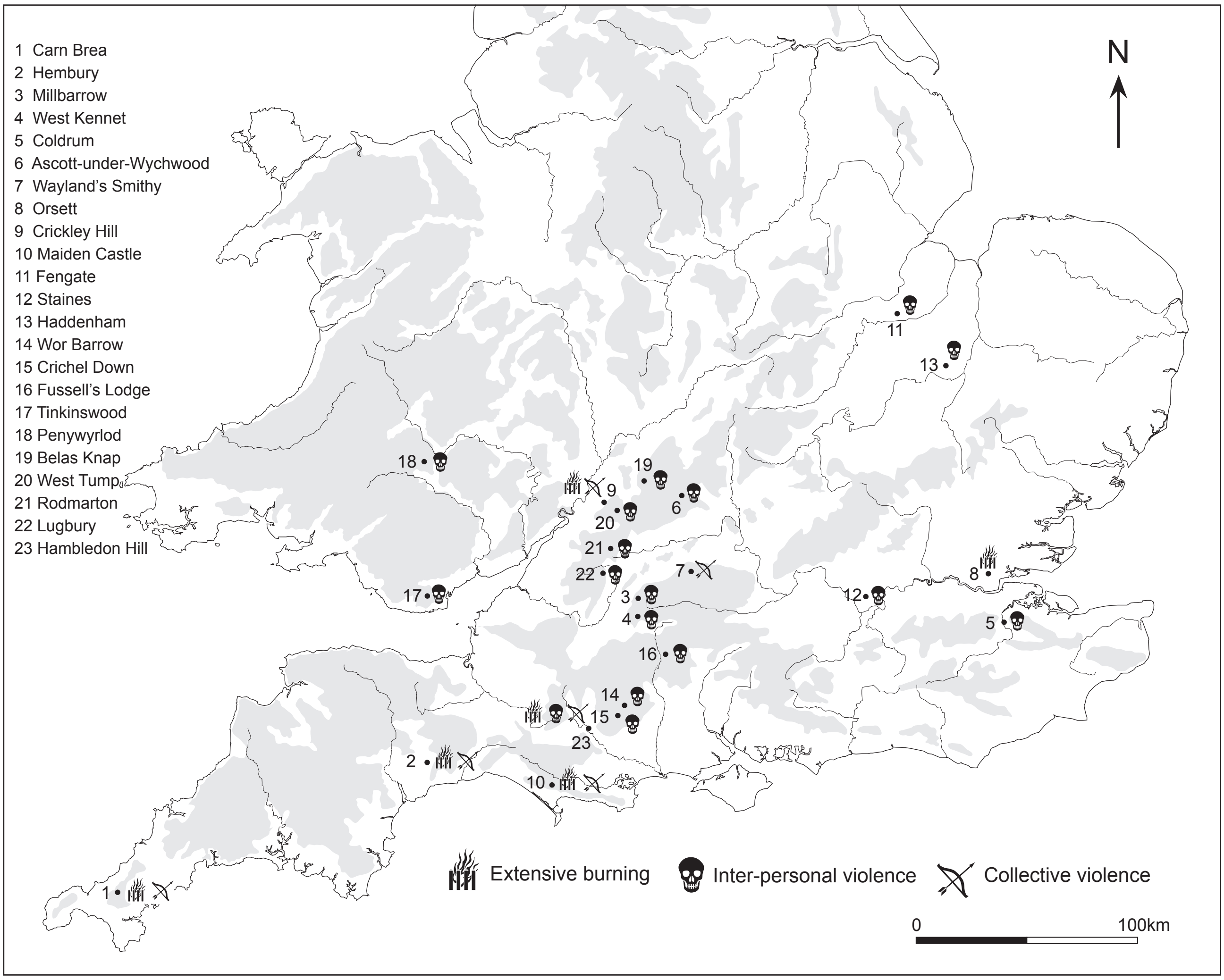


Fig. 14.37. Map of violent episodes in southern Britain in the fourth millennium cal BC. Note that inter-personal violence includes both cranial trauma and arrowhead wounds.

relation to an immediate threat has to be raised. An adult male buried on the base of the ditch of the burnt inner Stepleton outwork may have died in this conflict. A young man, buried in a pit with quantities of burnt material, may relate to the same event. Later on, in period 3, two young men died by arrowshot (Fig. 14.36: *UB-4243, ST78 2755A*). One of them lay on the base of the outer Stepleton outwork, and the other lay prone in the fill of the inner Stepleton outwork, above the base of the ditch (Figs 4.3, 14.36).

The episode which led to the deposition of nearly 400 arrowheads and extensive burning at Crickley Hill has been characterised as a battle: a violent assault (Chapter 9). The same seems to apply both at Hembury and at Carn Brea (Chapter 10), the latter with some 750 arrowheads in evidence as well as again extensive traces of burning. At Hembury there is a question of whether the burning events reflected in the inner and outer ditch circuits were exactly contemporary. Either the inner earthwork was constructed and then burnt soon after, to be followed by a repetition of the same sequence in the outer earthwork, or the inner earthwork stood for a while before being joined by the outer earthwork, with both then destroyed by fire at the same time. Our model for Hembury (Figs 10. 9–12) allows the possibility of two episodes of burning. There are numerous burnt arrowheads from the site (Chapter 10; Mercer 2006b). It is possible, though the evidence comes from much more restricted areas of excavation, that there were violent or dramatic events at Maiden Castle too, which could have produced the charcoal and scorching observed in the primary chalk rubble fills of the inner ditch, and the numbers of arrowheads recorded (Chapter 4; cf. Mercer 2006b). Given the very short timescale probably involved, this could again be seen as a case of anticipation of attack, though it may also have been the case that construction of enclosures aroused jealousies and tensions, and thereby precipitated attacks soon after. It is worth noting that, although the Carn Brea and Crickley Hill enclosures were respectively a stone wall and an almost continuous ditch with stone bank, Hembury, Maiden Castle and Orsett share the same kind of interrupted ditch circuit as other sites without evidence of attack. The outworks on Hambledon Hill also had interrupted ditches, but the evidence tends to suggest more continuous banks (Mercer and Healy 2008, figs 3.73, 3.81).

In terms of examples of individual deaths and violent encounters from other contexts, in the east there was an adult with arrowhead behind the sternum in the small mortuary deposit at Fengate (Chapter 6), and skulls with healed and unhealed wounds from the lower level of the chamber at Coldrum (Chapter 7). One of the five individuals from the Haddenham long barrow (Chapter 6) was associated with a leaf-shaped arrowhead, which in other instances can be shown to have been a cause of death. The dates for the deposits from which these remains were recovered at Coldrum and Haddenham are shown in Fig. 14.36; in these cases, the individuals themselves have not been directly dated and our estimates derive from samples in similar contexts.

Further west (Fig. 14.37), three individuals from Wayland's Smithy I might have met their deaths by arrowshot (Fig. 14.36: *OxA-13170, KIA-27624–5*; Whittle *et al*. 2007b); and the whole of the primary mortuary deposit might be related to some kind of massacre event (Whittle *et al.* 2007a). There was a leaf arrowhead 'in the region of the throat' of an adult male in the West Kennet long barrow, 'conceivably the cause of his death' (Fig. 14.36: *WK20*; Piggott 1962, 25). Another male, this time buried near the top of the primary fills of the ditch of Wor Barrow, in Cranborne Chase, had a leaf arrowhead among the ribs (Pitt Rivers 1898, pl. 251). Two antlers from the ditch base should predate this burial by only a short interval (Fig. 14.36: *BM-2283R, -2284R*). Elsewhere in Cranborne Chase, a leaf arrowhead was found among the ribs of an undated adult skeleton buried in a natural knoll on Crichel Down, (Piggott and Piggott 1944, 74–5). There was a probably healed wound on a skull from Millbarrow near Avebury (Schulting and Wysocki 2005, table 2); we have not been able to trace its exact context, and Fig. 14.36 shows estimates for the dates of individuals thought to be from the chamber (Chapter 3). Three skulls probably from the first deposits of the Fussell's Lodge long barrow (Wysocki *et al.* 2007; Michael Wysocki, pers. comm.) have healed wounds (Schulting and Wysocki 2005, table 2). Figure 14.36 follows the preferred model for the chronology of the barrow (Wysocki *et al.* 2007), although it should be noted that we have produced alternative models for the early history of this monument. In the eastern Cotswolds, one of the later individuals (B2) buried at Ascott-under-Wychwood died by arrowshot (Chapter 9; Benson and Whittle 2007; Bayliss *et al.* 2007c; Fig. 14.36: *GrA-25304*). More evidence comes from other chambered cairns in the Cotswolds, in the form of healed cranial wounds from Lugbury, Rodmarton, West Tump and Belas Knap (Schulting and Wysocki 2005, table 2); of these, only West Tump is dated, rather imprecisely (Fig. 9.24), but the crania in question have not been directly dated (Smith and Brickley 2006), and for these reasons we have not included this site in Fig. 14.36. Skulls with healed wounds have also been found at Hambledon Hill (Schulting and Wysocki 2005; McKinley 2008), one probably originally buried in the southern long barrow and the other from the phase VI slot in the main enclosure, but possibly redeposited; for these reasons, the dates of these contexts are not shown in Fig. 14.36. Further west again, in south Wales, there is evidence of individuals with both cranial wounds and arrowshot from Penywyrlod, and with cranial wounds from Tinkinswood (Chapter 11; Schulting and Wysocki 2005; Wysocki and Whittle 2000).

The greater number of samples showing evidence of violence affecting individuals from the west may be an artefact of the smaller number of large collective deposits of people in funerary constructions and the less frequent survival of bone in the eastern parts of the country. Whereas for enclosures we know that a significant number of sites in the east have been examined and there is not the kind of evidence for episodes of collective violence seen in the west, a significant number of early Neolithic human remains from other deposits in the east have not been examined. Overall, however, more than 350 skulls or crania have been examined from southern Britain and fewer than 9% show signs of trauma, healed or unhealed (Schulting and Wysocki 2005, 122). The wider significance of this evidence is discussed in Chapter 15.8.

14.3 Enclosures and other monuments in southern Britain

After the beginning of the Neolithic in Britain and Ireland, people began to make constructions with increasing frequency and of growing diversity: altering the earth, in Richard Bradley's phrase (1993). This cannot be seen as an absolute difference between the Mesolithic and Neolithic periods, since in the former people had built huts, shelters, platforms and possibly trackways, and had accumulated shell middens and dug pits in the ground – activities by no means confined to the latter stages of the Mesolithic (Allen and Gardiner 2002). After the start of the Neolithic, however, the number and scale of constructions and interventions of all kinds increase, ranging from shelters and houses, trackways and pits, to flint mine shafts and monuments. It is monuments above all which have figured in general characterisations of the nature of the Neolithic period, the assembly and application of labour for collective tasks of building on the one hand and the motivations for such enterprises on the other both being seen as distinctively new. There has been a general tendency to assume that such monumentality was a feature of the Neolithic from its beginning, though there have been signs in the recent literature of more discrimination (e.g. Cleal 2004; Healy 2004; J. Pollard 2004; Russell 2002; R. Bradley 2007; and see Whittle *et al*. 2007a), and some tendency, typological schemes of development notwithstanding, to assume that diverse forms of monuments co-existed.

This project has established that the distinctive form of monumentality represented by causewayed enclosures in southern Britain – involving conceptualising the generally circular enclosure of space, digging into the earth, piling upcast into banks, and on occasion building related timber structures such as palisades – probably began in the last quarter of the 38th century cal BC (Fig. 14.12). Did other forms of construction precede the building of causewayed

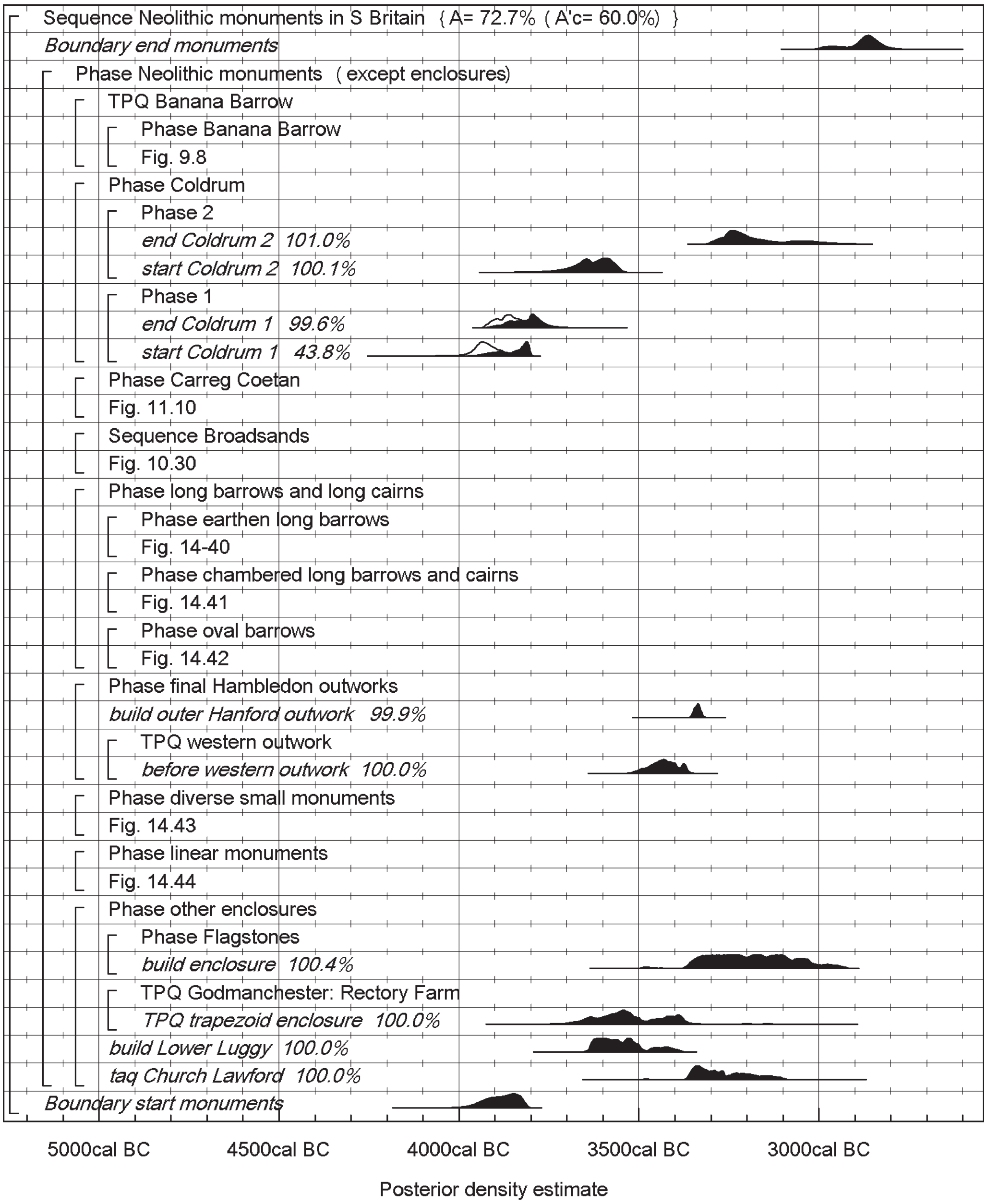


Fig. 14.38. Overall structure of the chronological model for the currency of early Neolithic monuments in southern Britain. The structures of the component sections of this model are shown in detail in Figs 9.8, 10.3, 11.10, and 14.40–2 and between the uniform phase boundaries of Figs 14.43–4 (although the posterior density estimates shown on these figures are not those relating to this model). Additional distributions have been taken from the models defined by Figs 4.7–13 (Hambledon Hill outworks), Fig. 4.48 (Flagstones), Fig. 6.15 (Godmanchester, Rectory Farm), Fig. 7.27 (Coldrum) and Fig. 11.15 (Lower Luggy and Church Lawford). The large square brackets down the left-hand side of Figs 14.38, 14.40–2, 9.8, 10.3 and 11.10, along with the OxCal keywords, define the overall model exactly.

enclosures? What forms did these take? What were the relative currencies of differing monument traditions? And what came after causewayed enclosures, and when?

Other monuments have been described and discussed in the regional chapters. Now is the time to examine them at a broader scale, in relation to the start and currency of causewayed and stone-walled tor enclosures in southern Britain. We have constructed five models to investigate the place of causewayed enclosures within the development of monumentality in the early Neolithic of southern Britain. None of these includes the dates from causewayed or tor enclosures themselves. First, an overall model which includes all other dated early Neolithic monumental constructions within our study areas has been built (Fig. 14.38), to determine whether enclosures were a primary feature of early Neolithic monumentality, and whether they were an ever-present component of it, or whether they were constructed and used for only part of the period. Then, three further broad categories of monument are presented: long barrows and cairns, along with oval barrows; diverse, small monuments, including ring ditches; and non-mortuary linear monuments, including

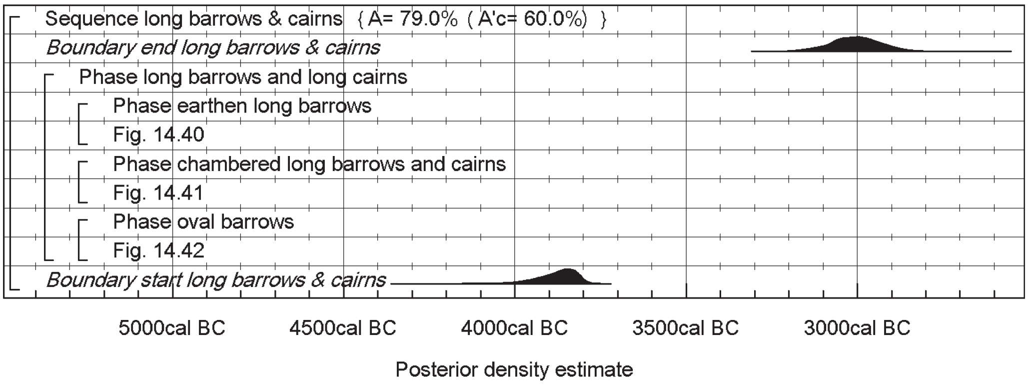


Fig. 14.39. Overall structure of the chronological model for the currency of long barrows and cairns in southern Britain. The component sections of this model are shown in detail in Figs 14.40–2. The large square brackets down the left-hand side of Figs 14.39–42, along with the OxCal keywords, define the overall model exactly.

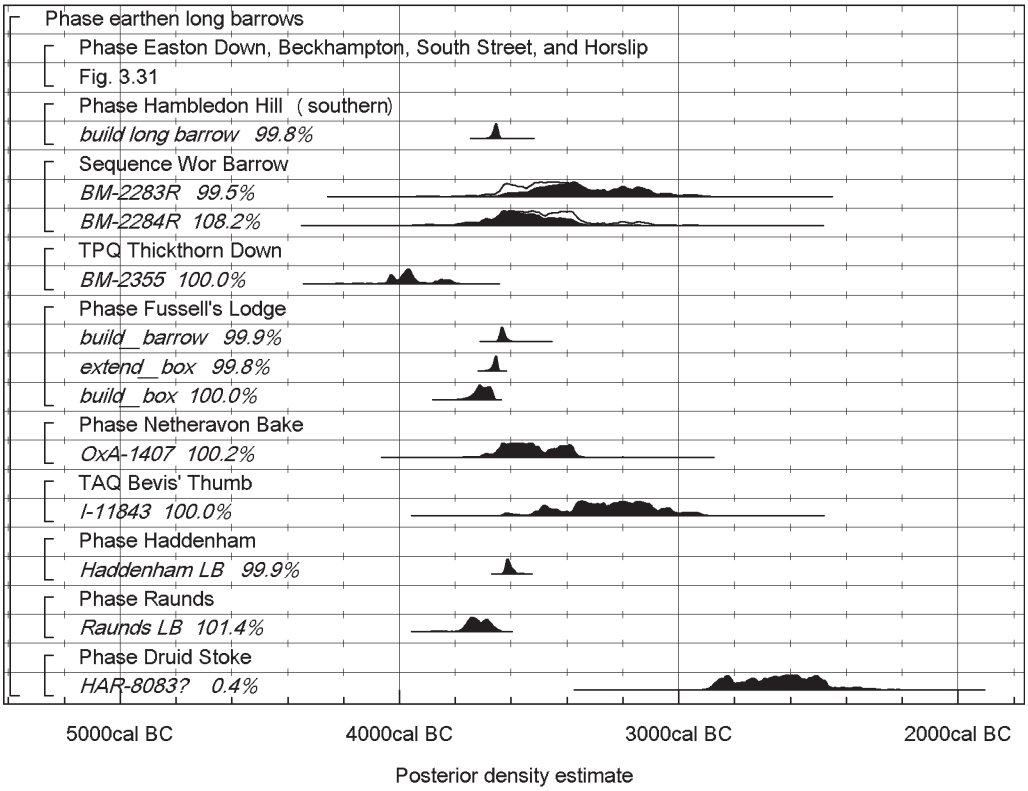


Fig. 14.40. Probability distributions of dates from earthen long barrows. The format is identical to that of Fig. 14.1. The structure of the component section of this model relating to Easton Down, Beckhampton, South Street and Horslip is shown in Fig. 3.31 (although the posterior density estimates shown on this figure are not those relating to this model). Other distributions have been taken from models defined in Figs 4.7–13 (Hambledon Hill), Wysocki et al. *(2007, fig. 10) (Fussell's Lodge), Figs 6.16–17 (Haddenham) and Figs 6.25–7 (Raunds). The overall structure of this model is shown in Fig. 14.39, and its other components in Figs 14.41–2.*

cursus monuments. Independent models to determine the currency of each of these traditions have been calculated (Figs 14.39–42, Fig. 14.43 and Fig. 14.44). An additional model has been constructed for long barrows and cairns, and oval barrows, in order to explore the currency of different architectural forms within this broad grouping (Fig. 14.45). The purpose of these models is to compare the currency of other Neolithic monument types with that of enclosures (Figs 14.45–6).

The overall form of the model for the construction and use of early Neolithic monuments in the areas of southern Britain where we have dated enclosures is shown in Fig. 14.38. Some of the components of the overall model have been taken from models defined in the regional chapters (although the posterior density estimates shown on these figures are not those relating to this model). For long barrows and cairns, and oval barrows, the components are defined in Figs 14.40–2, and for diverse, small monuments, and linear

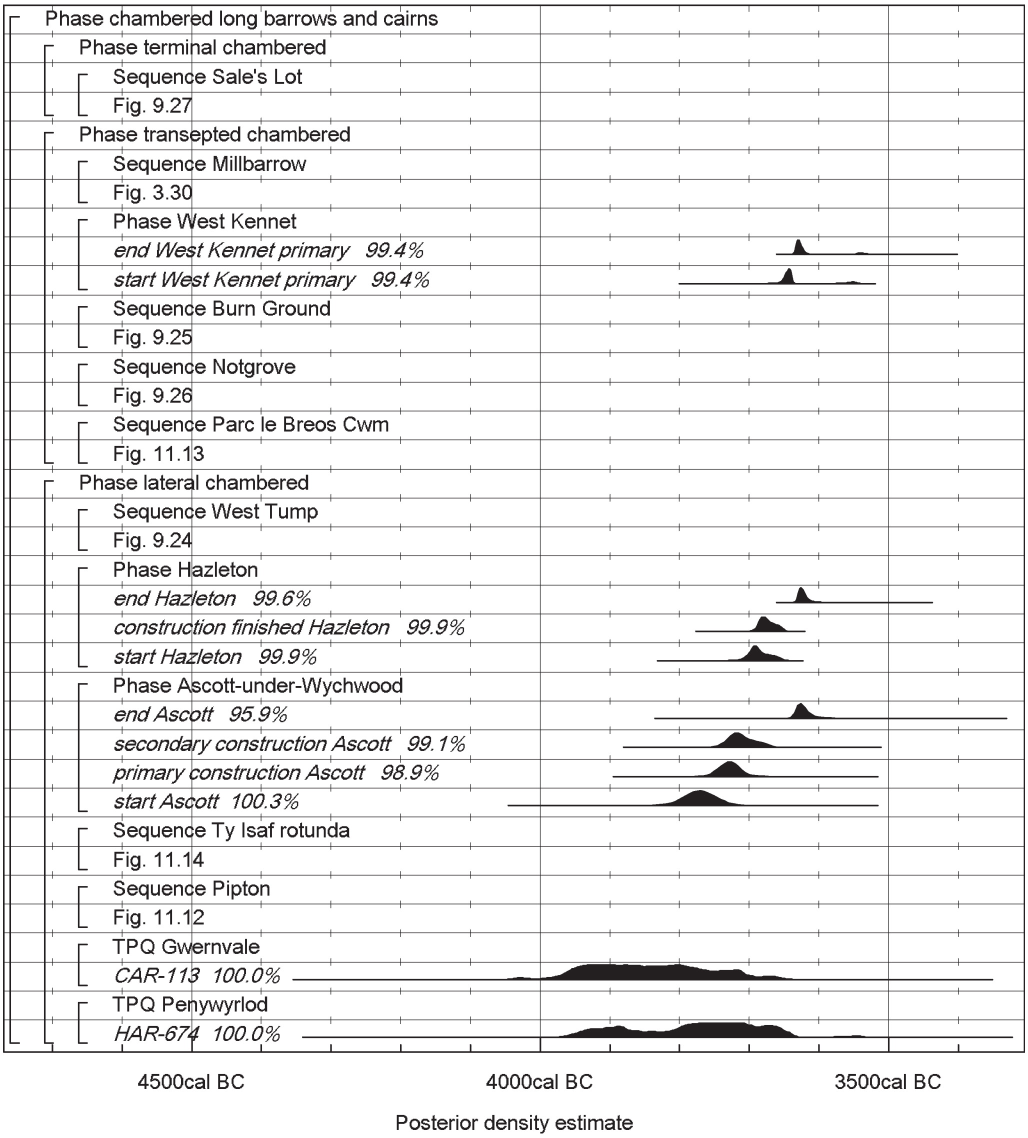


Fig. 14.41. Probability distributions of dates from chambered long barrows and cairns. The format is identical to that of Fig. 14.1. The structures of the component sections of this model are shown in Fig. 3.30 (Millbarrow), Figs 9.24–7 (West Tump, Burn Ground, Notgrove, and Sale's Lot), and Figs 11.12–14 (Pipton, Parc le Breos Cwm, and Ty Isaf) (although the posterior density estimates shown on these figures are not those relating to this model). Other distributions have been taken from models defined in Bayliss et al. *(2007b, fig. 6) (West Kennet), Meadows* et al. *(2007, figs 6–9) (Hazleton), and Bayliss* et al. *(2007c, figs 3 and 5–7) (Ascott-under-Wychwood). The overall structure of this model is shown in Fig. 14.39, and its other components in Figs 14.40 and 14.42.*

monuments, the components are defined within the phase boundaries shown in Figs 14.43–4. Many of the standardised likelihoods – that is to say, the dates for constructions and endings of individual monuments (Chapter 2.4.3) – have also been taken from models defined in the regional chapters; these are itemised in the captions to Figs 14.38–44.

The overall model suggests that the earliest monument in southern Britain was constructed in *3965–3810 cal BC* (*95% probability*; Fig. 14.38: *start monuments*), probably in *3915–3820 cal BC* (*68% probability*). Neolithic monumentality therefore began *70–250 years* before the first enclosure (*95% probability*; Fig. 14.47: *1st monument/1st enclosure*), probably *100–200 years* earlier (*68% probability*).

What form does this earliest monumentality take? Figure 14.38 shows the overall structure of a model for the currency of early Neolithic monuments in southern England. Our model includes 'classic' early Neolithic monuments such as long barrows and portal dolmens, but also modest, inconspicuous structures which are hard to classify, such as the Raunds avenue. The dates from the banana barrow on Crickley Hill are included, but only as *termini post quos* for the end of early Neolithic monuments (Fig. 14.38). The taphonomy of the dated material from this construction is uncertain, as indeed is its cultural affiliation (see Chapter 9). It remains an open question whether we regard this as a late Mesolithic or an early Neolithic construction. If we regard it as Neolithic

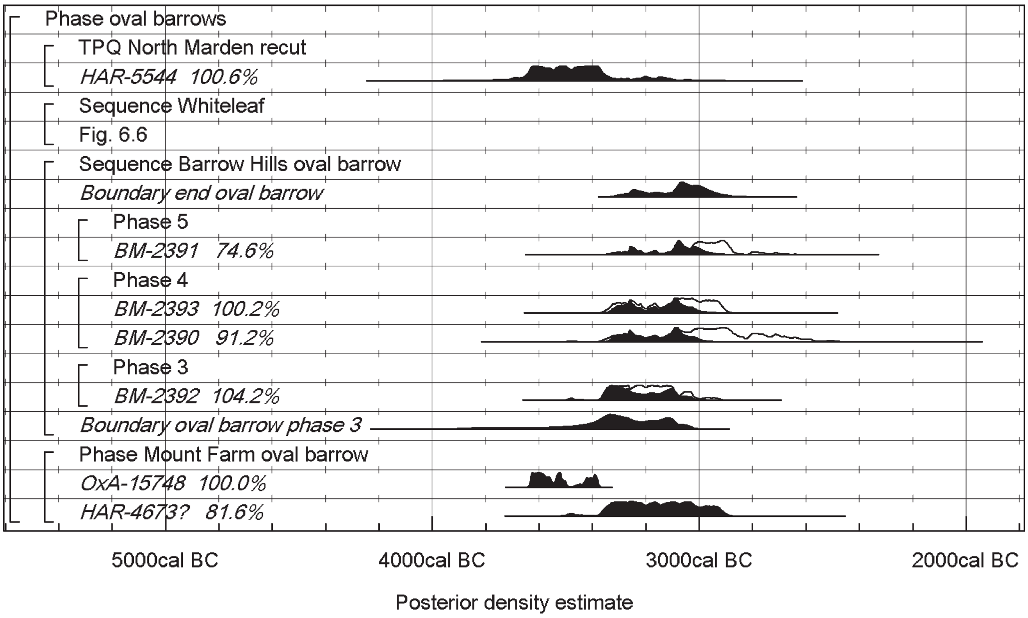


Fig. 14.42. Probability distributions of dates from oval barrows. The format is identical to that of Fig. 14.1. The structure of the component section of this model relating to Whiteleaf barrow is shown in Fig. 6.6 (although the posterior density estimates shown on this figure are not those relating to this model). The overall structure of this model is shown in Fig. 14.39, and its other components in Figs 14.40–1.

and the three consistent dates from it are not on residual samples, the effect would be to push the start of Neolithic monumentality slightly earlier. The early monument at Coldrum has been included in the model as a Neolithic construction (Fig. 14.38). Although the taphonomy of the dated material is poorly understood, there does seem to be a highly coherent group of radiocarbon dates on human remains, probably associated with the lower level of the stone box component of the monument, and perhaps thus its construction (see Chapter 7). If Coldrum forms part of the overall phase of early monumentality, then the weight of probability shifts to suggest a construction date for that site in the 39th rather than the later 40th century cal BC (compare Fig. 14.38 with Fig. 7.27). This simple arrangement may therefore stand at the beginning of the diverse tradition of stone-chambered monuments.

A model for the currency of the tradition of long barrows and cairns from the areas where we have dated causewayed enclosures is shown in Figs 14.39–42. This model estimates the start of the construction of monuments of this kind and the end of their use independently of the dates of all other early monuments. It suggests that this tradition began in *3995–3785 cal BC* (*95% probability*; Fig. 14.39: *start long barrows & cairns*), probably in *3910–3805 cal BC* (*68% probability*). It is *100% probable* that the first long barrow or cairn was constructed before the first enclosure (Fig. 14.47). The first long barrow or long cairn was built *50–275 years* before the first enclosure (*95% probability*; Fig. 14.47: *1st long barrow/1st enclosure*), probably *80–190 years* earlier (*68% probability*).

The practice of building long barrows and long cairns thus emerges before the first enclosures. The tradition was not uniform, since different types of barrows and cairns have long been recognised. A model for the currency of the varying forms of long barrow and cairn is given in Fig. 14.45. For each broad class, only a limited number of sites have been dated, and few have the precise chronologies that are now within reach (Bayliss and Whittle 2007). Some trends are, however, apparent. The first construction of chambered long cairns appears to have predated that of the first earthen long barrows (Fig. 14.45). It is, for example, *90% probable* that *start transepted* is before *start earthen*. Transepted long cairns may also have begun slightly earlier than lateral chambered cairns (*84% probable*). Caution at this stage is required, since the apparently early start for transepted cairns is entirely dependent on Burn Ground (Fig. 9.25). The number of dated terminal chambered cairns and oval barrows is so limited that it is impossible to place them reliably within the monument typology (although modifications to oval barrows at least appear to have continued to the end of the fourth millennium: Fig. 14.42). The terminally chambered monument at Sale's Lot appears to be relatively early within the tradition (Fig. 9.27). This contains a rotunda, which by association is also therefore relatively early, but it should be noted that the rotundae dated at Notgrove (Fig. 9.26) and Ty Isaf (Fig. 11.14) fall in the middle centuries of the fourth millennium cal BC. If not all rotundae are as early as has often been argued, we should also note that, on the basis of the single dated site of Carreg Coetan (Fig. 11.10; and see discussion of Poulnabrone in Chapter 12), neither are all portal dolmens.[5]

The establishment of new long barrows and cairns was a long-lived practice, spanning almost the whole of the fourth millennium cal BC (Fig. 14.39). Unlike enclosures, where new sites were established over a period of less

than 200 years (*initiation S British enclosures*; Fig. 14.6), long barrows and cairns continued to be built into the last quarter of the fourth millennium (e.g. Millbarrow; Fig. 3.30). We can also bring in Wayland's Smithy here; the construction of its second, transepted phase probably dates to the 35th century cal BC, significantly later than, for example, the typologically very similar West Kennet long barrow which appears to have been built in the mid-37th century cal BC (Bayliss *et al*. 2007b; Whittle *et al.* 2007b). Were the circumstances surrounding the construction of these later examples the same as those of the initial examples in the same architectural form? Is there a conscious archaising here, and could such self-consciousness imply that the significance of these monuments had already substantively altered? There is a potentially significant contrast here between a more concentrated period of enclosure construction and a longer currency of barrow construction. The length of that currency makes it questionable whether enduring form was synonymous with unchanging meaning.

It is important not to confuse the currency of a monument tradition with the duration of use of individual sites. We have already seen that causewayed enclosures in southern Britain were used over a period of *385–485 years* (*95% probability*; Fig. 14.27: *use S British enclosures*), probably over a period of *400–455 years* (*68% probability*). Particular enclosures that were in use for this extended period of time were, however, the exception rather than the rule (Fig. 14.32). Only Etton, Windmill Hill and the enclosures on Hambledon Hill are strong candidates for having continued in use for more than 200 years, and a number of the others seem to have been in use for less than a human lifespan. Long barrows and cairns were constructed over a much longer period in the fourth millennium cal BC compared to enclosures (Fig. 14.46). On the basis of a small number of precisely dated sites (Whittle *et al*. 2007a, fig. 6), the dominant mode of their primary use may have been relatively brief: for up to a century but frequently less. On the basis of the extended series presented here, this trend may be robust, with perhaps only Notgrove (Fig. 9.26) and Pipton (Fig. 11.12) emerging as candidates for periods of use longer than 200 years.

A model for the chronology of a disparate collection of diverse, small monuments from the areas where causewayed enclosures have been dated in southern Britain is given in Fig. 14.43. Both the number of dated monuments and the precision of their chronologies are limited, but the model suggests that the earliest in this grouping dates to *3910–3535 cal BC* (*95% probability*; Fig. 14.43: *start diverse & small*), probably to *3770–3600 cal BC* (*68% probability*). It is *94% probable* that the first of these sites is later than the first long barrow or cairn, although it is only *66% probable* that the first of these sites is later than the first enclosure.

The Staines Road Farm ring ditch (see Chapter 8), and the very different monument of the Raunds turf mound in the Nene valley (see Chapter 6) are probably the earliest dated constructions within this grouping (Fig. 14.43). Form and associated artefacts suggest that the undated first phase of Horton in the middle Thames (see Chapter 8), and ring ditches associated with Mildenhall Ware at Brightlingsea, Essex, and Rainham, Greater London (see Chapter 7) may have been of comparable age. A diversity of form – encompassing among other features all manner of generally small circular and square ditches, other trenches and slots, a deep chalk shaft, various timber settings, inhumations, and depositions of artefacts, animal bones and other material – continued to be employed till at least the end of the fourth millennium cal BC. Apparently starting in the same period as the first hey-day of enclosure construction, a variety of generally much smaller, non-standardised, often funerary monuments continued to be built and used for much longer. Given that these constructions seem to have originated broadly at the same time as enclosures, they may have been part of the same social world, but operating on a more individual and more local level.

A model for the chronology of the varied linear monuments, as described in the regional chapters, from within the areas of southern Britain where we have dated causewayed enclosures is shown in Fig. 14.44. This form of construction is notoriously difficult to date due to the paucity of associated material of any kind (R. Bradley 1986; Barclay and Bayliss 1999). The model we have chosen to present in Fig. 14.44 excludes the luminescence ages for the two Eynesbury cursus monuments, and the problematic dating of the long mound at Raunds, for the reasons discussed in Chapter 6. Our model suggests that this type of construction first appeared in *3915–3545 cal BC* (*95% probability*; Fig. 14.44: *start linear monuments*), probably in *3795–3610 cal BC* (*68% probability*). This form of monument may have continued into the third millennium cal BC (Fig. 14.44). It should be noted that because of the very limited number of dated samples this model more closely relates to the construction of linear monuments than their use. It is therefore more comparable to the model for the establishment of new causewayed enclosures (Fig. 14.5) than to that for the currency of enclosures (Figs 14.1–4 and 14.27).

Although it is unclear from this model whether the first linear monument in southern Britain was constructed before or after the first enclosure, this ambiguity is largely a product of the imprecise dating of linear monuments as a whole.

At least when considering larger cursus monuments, it appears that the construction of individual examples of this form followed that of causewayed enclosures. In support of the primacy of enclosures, we can cite the excavated relationship between causewayed enclosure and cursus monument at Etton (Chapter 6), that between causewayed enclosure and long mound at Maiden Castle, and the air photographic evidence from Fornham All Saints (Chapter 6). The dated relationship of the Hambledon Hill enclosures and the Dorset cursus in Cranborne Chase (Chapter 4) is also compatible with this sequence. It is *90% probable* that the Dorset cursus was built after activity on Hambledon Hill had ceased, although the construction of the extensive phase 4 western outworks at Hambledon may have presaged

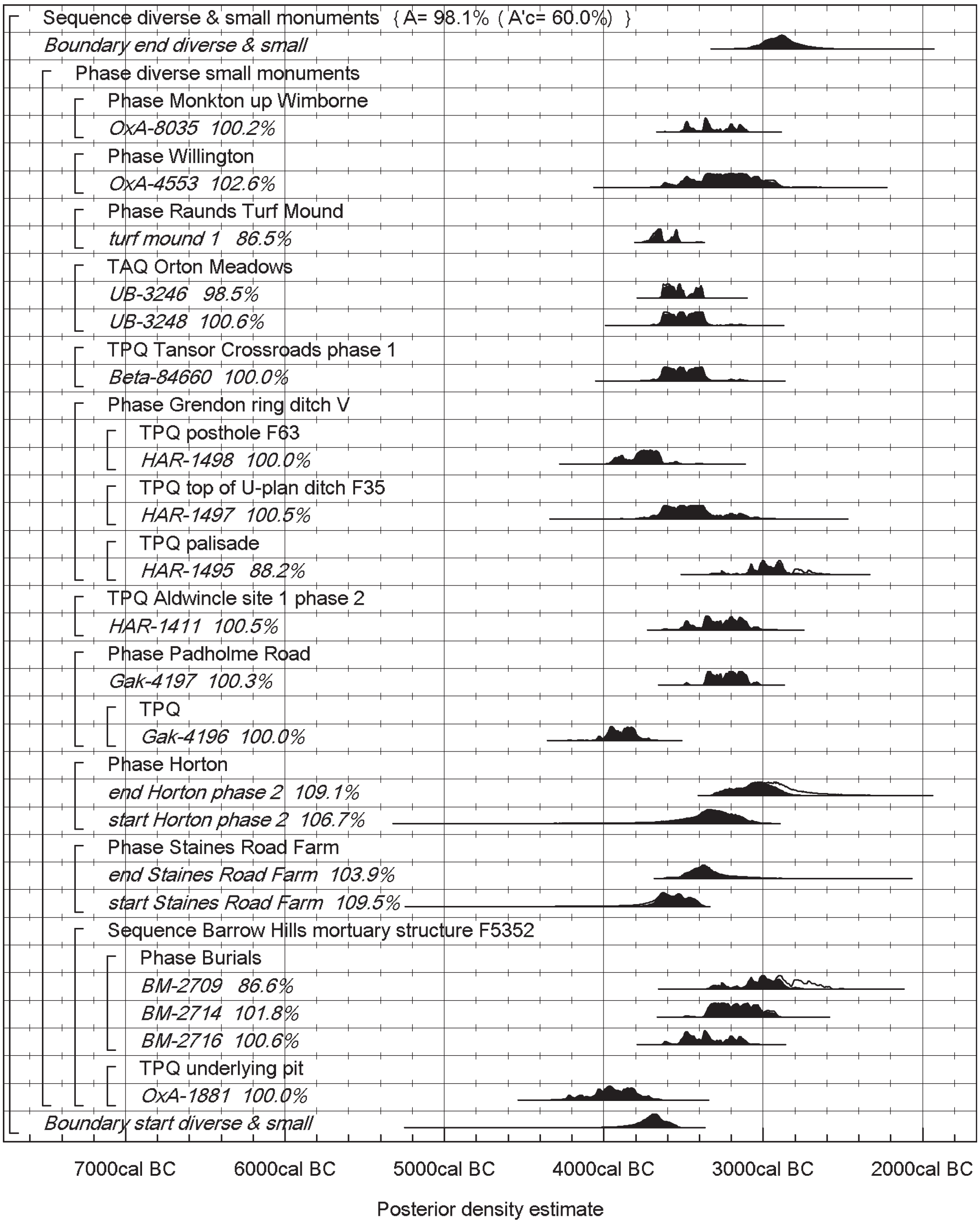


Fig. 14.43. Probability distributions of radiocarbon dates from diverse and small monuments. The format is the same as for Fig. 14.1. Some distributions have been taken from models defined in Figs 6.25–7 (Raunds) and Fig. 8.7 (Horton and Staines Road Farm). The model is defined exactly by the OxCal keywords and the brackets down the left-hand side of the diagram.

a shift in orientation towards the Chase (see discussion in Chapter 4). The dated relationship of the Abingdon enclosure and the Drayton cursus (Chapter 8) is less certain, although there is a sporting chance (*63% probable*) that in this case the cursus may have been earlier, if only by a generation or two. It may be that, after the period of intensive construction of causewayed enclosures was over, perhaps in the third quarter of the 36th century cal BC (Fig. 14.7), new major monumental undertakings were directed into extended linear form. The dating of the Drayton cursus may perhaps point to a short phase of overlap in the last quarter of the 37th and the first half of the 36th century cal BC, when people chose between accepted and new forms of construction. With regard to other enclosures (and see below), the trapezoidal enclosure at Godmanchester is stratigraphically earlier than the attached cursus (Chapter 6). The idea of linearity may, however, have its origins earlier than the building of the massive linear monuments. The shallow, discontinuous, 60 m-long Raunds avenue, probably dating to the 38th or 37th century cal BC (Fig. 14.44: *the avenue*), is the best southern British example at present,[6] and is not a classic ditched and banked cursus.

The final strand to consider is that of a handful of enclosures other than the causewayed and stone-walled tor enclosures of southern Britain. The dated examples in question, considered in the regional chapters, comprise

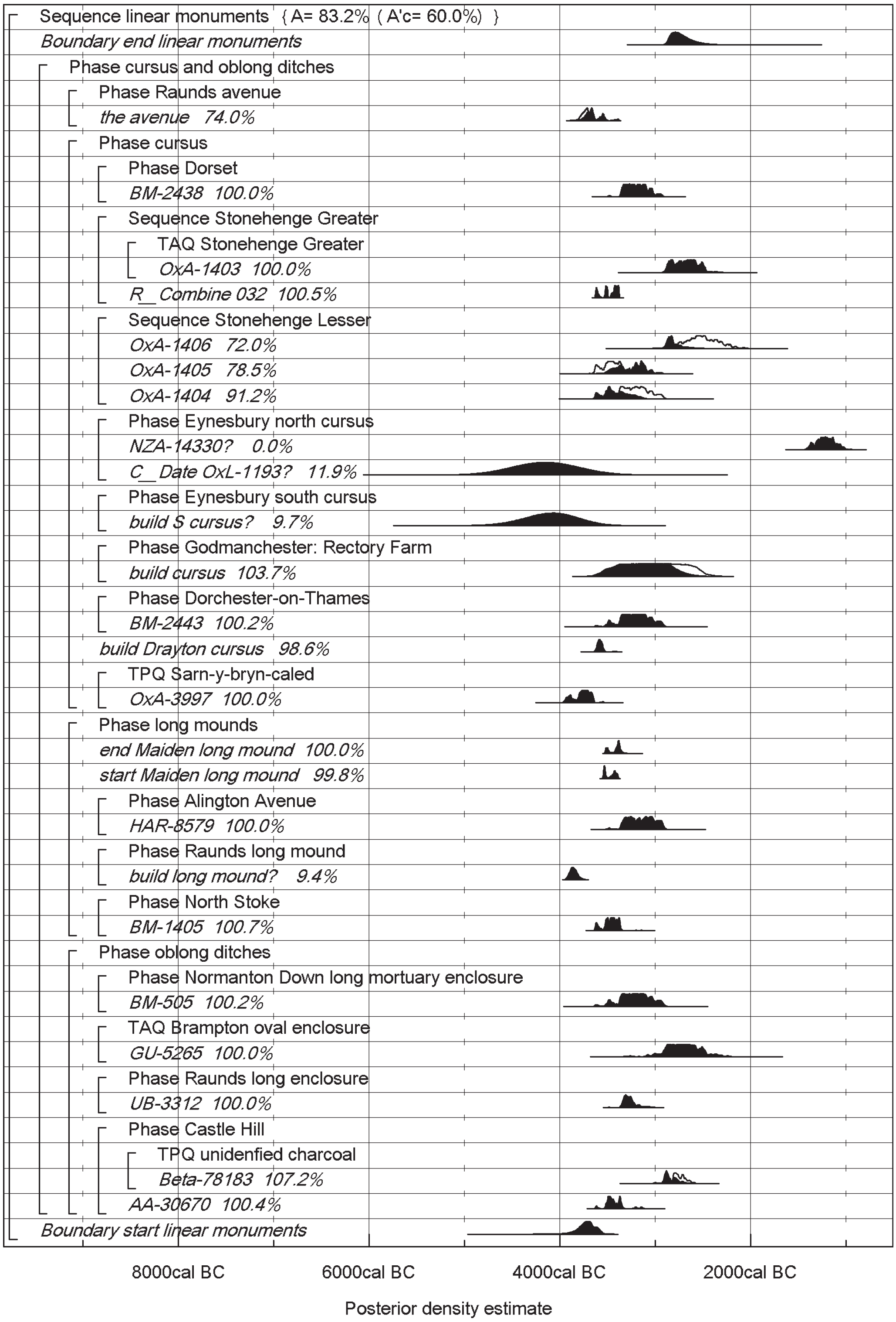


Fig. 14.44. Probability distributions of radiocarbon dates from linear monuments. The format is the same as for Fig. 14.1. Some distributions have been taken from models defined in Figs 4.41–5 (Maiden Castle), Fig. 6.13 (Eynesbury), Fig. 6.15 (Godmanchester, Rectory Farm), Figs 6.25–7 (Raunds) and Fig. 8.30 (Drayton). The model is defined exactly by the OxCal keywords and the brackets down the left-hand side of the diagram.

Godmanchester, Lower Luggy, Church Lawford and Flagstones (Fig. 14.38). As noted in Chapter 4, Flagstones is much more circular in form than any known causewayed enclosure, and comfortably post-dates the period of causewayed enclosure construction. The first phase of Stonehenge is an obvious point of comparison, both in terms of form and date (Cleal *et al*. 1995; Bayliss *et al*. 1997). As discussed in Chapter 6, there is nothing like the trapezoidal enclosure at Godmanchester anywhere else in southern Britain (or indeed beyond). It seems

best to consider it as part of the considerable diversity of monumental construction that characterises the middle part of the fourth millennium cal BC. It belongs to an area of the country where the other, smaller monuments, if not the causewayed enclosures, show considerable variation in scale and layout. However impressive the size and complexity of its layout, and whatever arcane purposes this may have had, it was presumably the product of local or particular circumstances: an idea that did not catch on elsewhere. That may provide an interesting insight into the conditions of innovation. In comparison with causewayed enclosures and long barrows and cairns, perhaps there was insufficient authority for the idea to be legitimated and thus fully accepted elsewhere. The last two examples, Lower Luggy and Church Lawford, are also trapezoidal or sub-trapezoidal, though much smaller than Godmanchester. There are a number of other non-causewayed enclosures, such as Hill Croft Field in Herefordshire (Chapter 11) and Bury Hill in Sussex (Chapter 5), so we are not proposing a separate class or sub-group of trapezoidal enclosures. We can see these two particular sites as further evidence of the diversity of construction in the mid-fourth millennium cal BC, and there must be many more like them waiting for a Neolithic date to be established by further fieldwork, Nymet Barton in Devon being one possibility (Chapter 10).

Our estimates for the currency of different monumental traditions in the early Neolithic of southern Britain are shown in Fig. 14.46. It is clear that causewayed and stone-walled enclosures are not the first monumental form to appear (*100% probable*). It is *87% probable* that the earliest form of monument is the long cairn (earthen long barrows appearing slightly later: Fig. 14.45). It is possible, however, that there may have been varied antecedents, such as we have seen at Coldrum, before more recurrent types were established. It is not clear whether other, diverse monument types appeared at the time when enclosures were built. We do not know whether the first diverse and small monument (as defined above) was constructed before the first enclosure (*34% probable*), nor whether the first linear monument was constructed before the first enclosure (*44% probable*). Enclosures could have formed part of a set of innovative constructions, all appearing in a concentrated horizon. Alternatively, new forms could have appeared sequentially. Until other monument types are dated to the resolution provided for enclosures here, we simply do not know. Their dates can be 'sucked in' to the currency of enclosures, or 'smeared' away (Baillie 1991). Furthermore, there may be sequence hidden within the broad monument typology considered here. We have already mentioned that discontinuous linear monuments, such as the Raunds avenue, may be earlier than more classic cursus monuments, and seen hints of temporal trends in the classification of long barrows and cairns (Fig. 14.45). Our analysis has relied on broad groupings, forced on us by the quality of dating available for monuments other than enclosures. More detailed consideration of trends and fashions in monument building through time must also await further research programmes of the kind presented here for enclosures.

14.4 Enclosures and the start of Neolithic activity in southern Britain

We come now to defining the place of enclosures in the scheme of things: the date of their appearance in relation to our estimates for the start of definably Neolithic activity across the regions covered in this study. This has been covered only partially in the regional chapters thus far, depending on local circumstances.

We have presented our chronologies so far in a series of defined regions, the extent of which varies, following the availability of dateable enclosures. This has not provided total coverage of southern Britain. We have not dated enclosures in Somerset, nor in Hampshire, parts of Berkshire, Surrey south of the Thames or Greater London. In looking for evidence of dated early Neolithic activity beyond enclosures, we have not searched those same areas, and so the Somerset Levels, a large tract of chalk downland in Hampshire and Berkshire, including the Isle of Wight, and the Weald, barely figure in our account so far.

Some of these lacunae are simply the product of a project designed in the first place to date early Neolithic enclosures. There is, of course, a good understanding of many aspects of sequence and development in the Somerset Levels (Coles and Coles 1986), and parts of Hampshire, including the Isle of Wight, the Berkshire downs and Surrey (e.g. RCHME 1979; Loader 2007; Cotton and Field 2004; Field and Cotton 1987). London may present a different situation. Although the city occupies a large area, there has now been substantial archaeological coverage, and a recent synthesis suggests, notwithstanding axehead finds from the river itself, the presence in the early Neolithic of extensive marshland and backswamp, probably very unfavourable for occupation (Wilkinson and Sidell 2007; Sidell and Wilkinson 2004). Analysis of over 1000 radiocarbon dates from the capital also shows very little dated Neolithic human activity (Meadows *et al.* forthcoming). The sands and gravels of the Weald have long been a prolific collecting ground, and the lithics leave no doubt of an early Neolithic presence (Gardiner 1984, fig. 3.2; Field and Cotton 1987, 77–79, 93, figs 4.7, 4.15), often on sites already used in the Mesolithic. Subsoil features, let alone monuments, remain elusive, however, and may have been scarce or absent.

We will now present the evidence for dated early Neolithic activity derived from sites other than enclosures region by region, starting in the south-east and moving westwards. For this purpose, we will use a slightly different regional division than in the earlier chapters (Fig. 14.48). This is to achieve a more balanced coverage, so that each region covers a reasonably large area and so that there is a reasonable number of dated samples available for each unit of analysis. The approach is entirely pragmatic. So here we will treat the middle Thames valley separately from the upper Thames valley, to reflect the considerable amount of development and archaeological research in this area, which allows a relatively refined picture of the early Neolithic to emerge in this region. We will also distinguish north Wessex (amalgamating north Wiltshire with Salisbury Plain) from south Wessex (i.e. the remainder of the Wessex

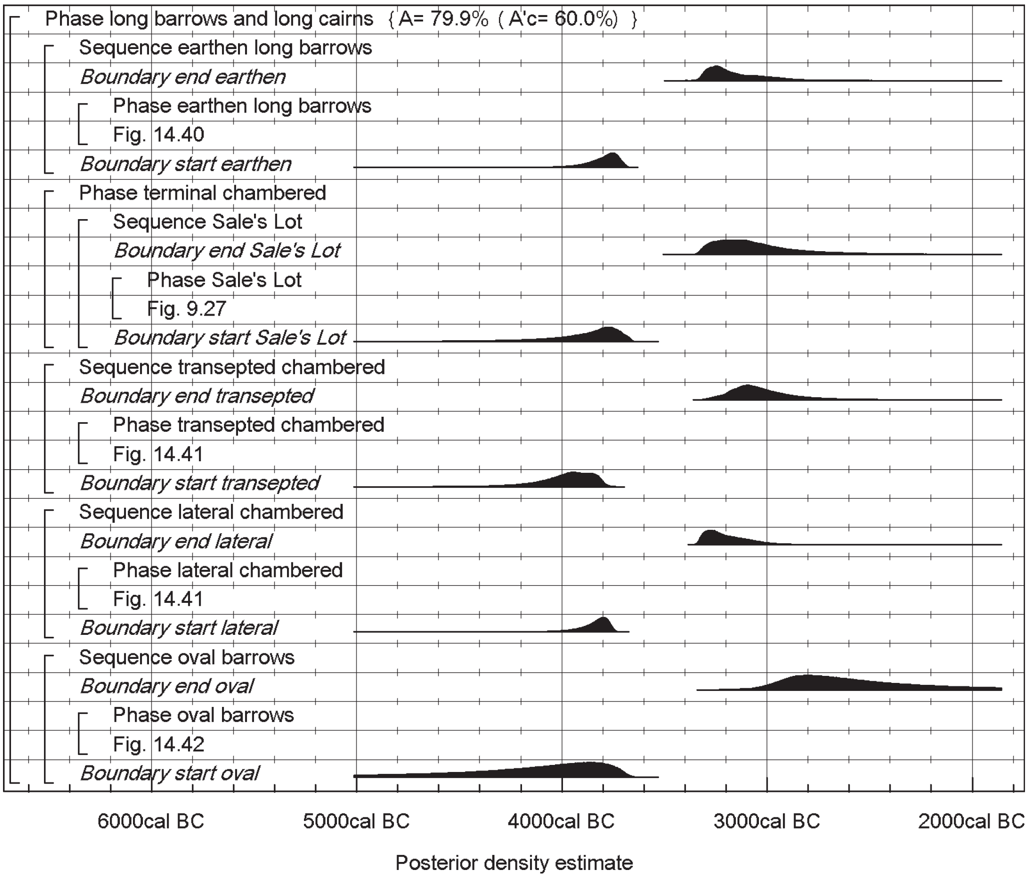


Fig. 14.45. Overall structure of the chronological model for the currency of types of long barrows, long cairns, and oval barrows in southern Britain. The structures of the component sections of this model are shown in detail in Figs 9.27 and 14.40–2 (although the posterior density estimates shown on these figures are not those relating to this model). The large square brackets down the left-hand side of these figures along with the OxCal keywords define the overall model exactly.

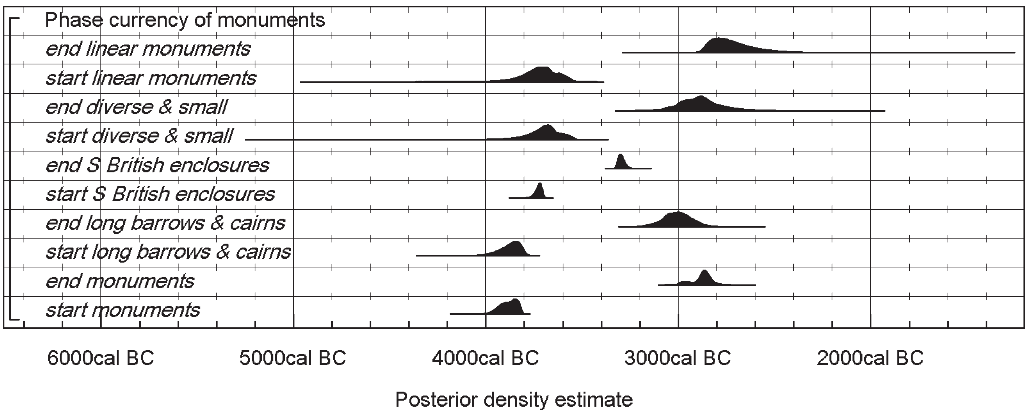


Fig. 14.46. Probability distributions of the currencies of enclosures (Figs 14.1–4), early Neolithic monuments overall (Figs 14.38, 14.40–2, 9.8, 10.3 and 11.10), long barrows (Figs 14.39–42), diverse and small monuments (Fig. 14.43), and linear monuments (Fig. 14.44).

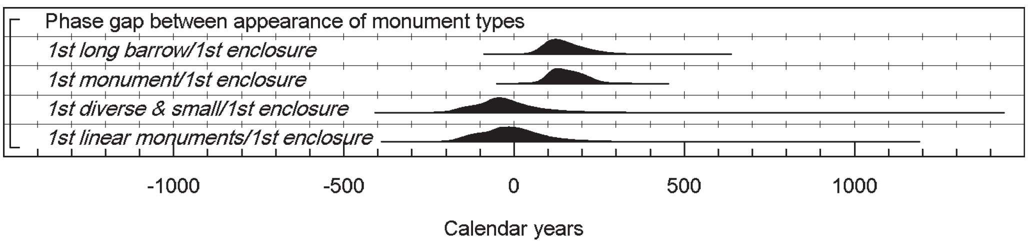


Fig. 14.47. Probability distributions showing the number of years between the first monument of a particular type and the first causewayed enclosure (derived from the distributions shown in Fig. 14.46).

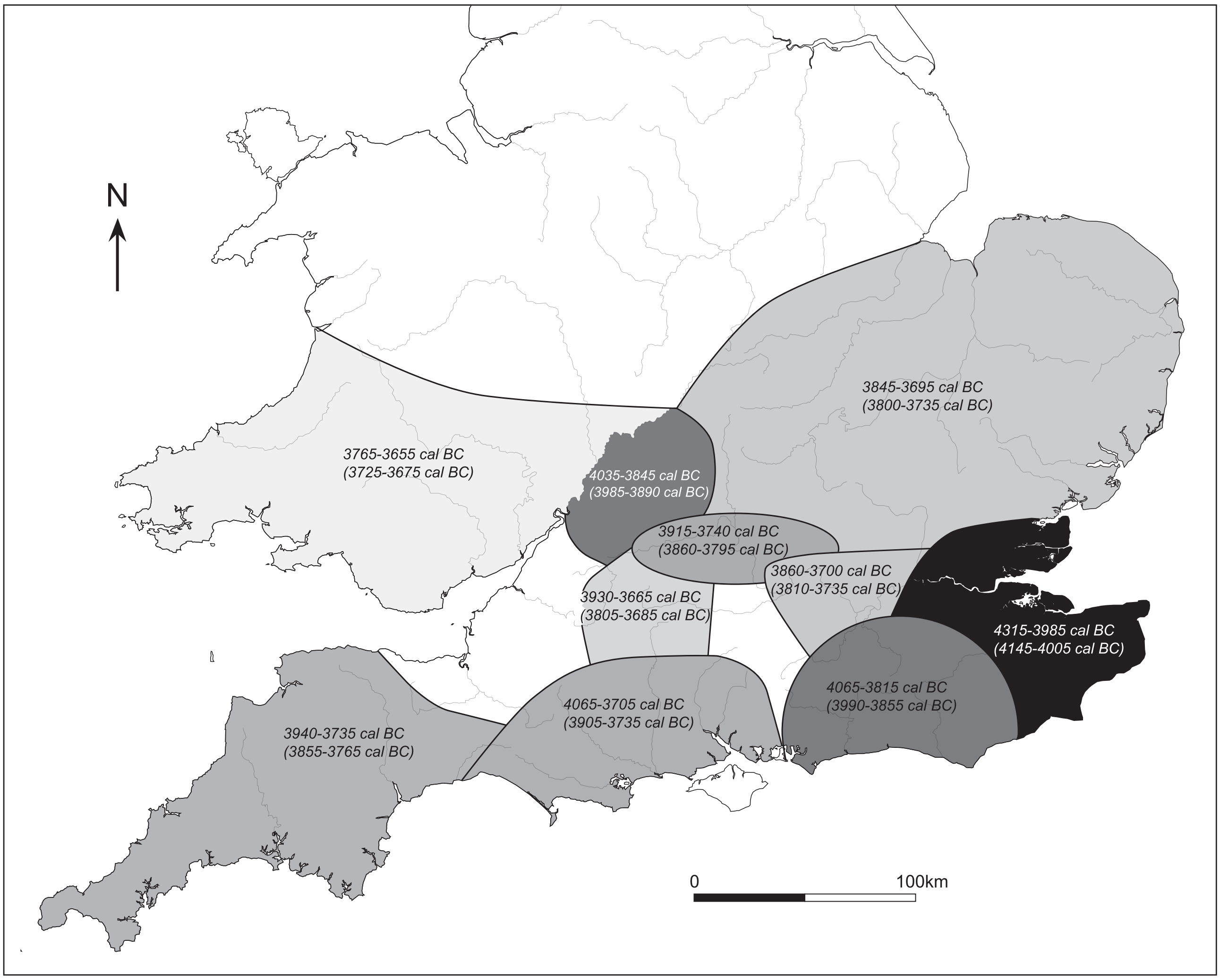


Fig. 14.48. Map showing date estimates for the start of Neolithic activity region by region in southern Britain, at 95% probability (68% probability in brackets).

area covered in Chapter 4). This expands the very small area covered in Chapter 3 to form a more viable unit for this analysis.

As we have seen in Chapter 2.2, scatter matters. In order to counteract the inescapable statistical scatter on a group of radiocarbon dates, it is necessary to model the statistical distribution of the dated activity. Failure to do this normally leads to an inaccurate assessment of the date of archaeological activity represented, with this seeming to start earlier, end later, and endure for longer than was actually the case (Buck *et al.* 1992; Bayliss *et al*. 2007a; 2008b; Bayliss 2009). For a statistical distribution to be implemented, it is necessary to define the end as well as the beginning of the period of archaeological activity. For the Neolithic, this presents a problem. The Neolithic began in southern Britain, but some of its innovations, most obviously farming, persist today. This is in contrast to the situation with causewayed enclosures, which were built, were in primary use for a period of time, and then went out of use. Defining the enclosure endings may not be unproblematic (see, for example, Chapter 3), but the enclosures are not still used for their original purpose. We still grow cereals.

We have a dilemma. The uniform-phase model which we have implemented here demands an ending, where archaeologically there is none. Pragmatically, again, we have deliberately defined our criteria for Neolithic activity to include certain types of artefacts and sites which have an early Neolithic currency. So, for example, one of the markers for the end of this phase is the end of the use of Bowl pottery and the beginning of the use of Peterborough Ware. Compromises have had to be made. Early dates on cereals and domesticated fauna have been included in these models, even where they are not known to occur in association with other material or features defined as diagnostically Neolithic, although their use continues beyond the end of the early Neolithic. If the radiocarbon age lies within the range of those associated with diagnostic artefacts or sites, it has been included (in fact, cases such as these represent less than 7 percent of our dataset); if it is later, it has not. We have been pragmatic here. It has seemed perverse to ignore very early dated occurrences of

cereals. For example, we have used a date on cereal from Manor Way, Woolwich (Table 7.6: Beta-153983), even though we have no certain evidence that it was associated with other Neolithic material. These issues have already confronted us in modelling the introduction of Neolithic practices to Ireland (Chapter 12), where we have separated some of elements of the assemblage of Neolithic things and practices, and incorporated them in alternative models.

We have therefore included radiocarbon dates in our models for the early Neolithic in southern Britain, if the dated sample is directly associated with cultural material that we have defined as diagnostically Neolithic, or if it derives from a site whose architecture or form we have defined as diagnostically Neolithic, or if the sample itself is of material that we have defined as diagnostically Neolithic. Our criteria for definably early Neolithic activity include material culture (principally forms of Bowl pottery, leaf arrowheads and ground axeheads), domesticated plants and animals, and forms of architecture including all manner of constructions in earth, turf, chalk, gravel, timber and stone. Bowl pottery includes Carinated Bowl and the South-Western and Decorated styles. In contrast to the record from the other side of the North Sea, for example in the Rhine-Meuse estuary, where the first pots in sites like Hardinxfeld-Giessendam first appear in an otherwise hunter-gatherer milieu, to be joined gradually by other Neolithic elements (Louwe Kooijmans 2007), there is no hint in southern Britain of such material in late Mesolithic contexts or associations.

There is likewise no sign that leaf arrowheads were made in the late Mesolithic in southern Britain. Neolithic axeheads, of stone and flint, are of different forms to their Mesolithic counterparts, and were regularly finished by grinding or polishing – a technique only employed as far as we know, in the Mesolithic in Ireland (Cooney 2000a) and south Wales (David and Walker 2004). Generally in southern Britain neither the finished lithic artefact forms produced in the early Neolithic nor many of the materials employed (including deep-mined flint and rocks from remote sources) were current in the Mesolithic. There is no evidence for deep shafts being used for flint extraction in the southern British Mesolithic, and no certain evidence that the sources used for stone axehead manufacture in the Neolithic were in other than local use in the Mesolithic. There are, furthermore, precedents for these kinds of pots, projectile points and axeheads – as well as for flint mining – in continental Europe in the fifth millennium cal BC, even if there are also insular continuities in terms of core reduction and blade technology common to the late Mesolithic and early Neolithic in southern Britain.

Neither cereals nor sheep and goat were native to Britain, let alone Europe as a whole, and there is now genetic evidence that domesticated cattle derived from different populations to native aurochs (e.g. Bollongino and Burger 2007; Edwards *et al*. 2007); the situation with pigs may be comparable, though the currently available evidence can allow local domestication as well (Larson *et al.* 2007). Unlike in Ireland, where Ferriter's Cove provides the possibility of detecting an initial transfer of cattle into the island in a late Mesolithic context because there is no evidence of a native cattle population in the post-glacial period down to the start of the Neolithic, there is no reliable sign in Britain as a whole of domesticates in Mesolithic contexts. Finally, there is no evidence that Mesolithic people recurrently undertook the range of larger-scale buildings and diggings that go under the general label of monuments.

The rectangular timber houses found in Neolithic association are also both more substantial and of different form to anything in Mesolithic contexts in Britain. Known Mesolithic structures are small and rounded, and there are again continental precedents for rectangular houses in the fifth millennium cal BC in adjacent Europe. Some circular buildings have been dated to the fourth millennium cal BC in southern Britain (as at Penhale Round, Cornwall: Chapter 10), but we have only accepted them as certainly Neolithic for this analysis here where associated with other diagnostically early Neolithic material culture (as at Yarnton, Oxfordshire: Chapter 8).

In some of the regional chapters, the tables list radiocarbon dates with robust associations with diagnostic criteria for Neolithic activity separately from dates on other fourth millennium cal BC samples. There are certainly a number of dates in this latter category where there is good cause to suppose that the activity was indeed Neolithic in character. For example, some of the dated pits from Llandysul in south-west Wales (Chapter 11) are associated with diagnostic pottery and have been included in our model for the early Neolithic in south Wales and the Marches. Other dated pits there without diagnostic material associations, however, have not been included, although, as they are of the same general character and lack Mesolithic material, plausibly they are also Neolithic. As another example, burials in caves which are not associated with diagnostic Neolithic material culture and which simply have a fourth millennium cal BC date are not classed by us as Neolithic for the purpose of this analysis, although those with terrestrial isotopic dietary signatures probably were. In including dates in these models, our criteria, for both association and taphonomy, are deliberately severe. This is to ensure that our models estimate the dates for the assemblage of Neolithic things and practices which we have explicitly defined – it is not enough to take a fourth millennium date as indicating that an activity is Neolithic, as our objective is to independently determine the date of the early Neolithic.

It is important to understand the difference between the range of Neolithic things and practices that the models presented here are dating and the Neolithic 'package' that has so often been discussed in the literature (see Chapter 1.5). For inclusion in the models, a radiocarbon date has to be associated with one diagnostic criterion. This means that we are estimating when Neolithic material and practices first appeared in an area; this is not necessarily the time when the entire economic and ideational scheme changed. Our models do not therefore assume that the entire range appeared together all at once. We will first examine the

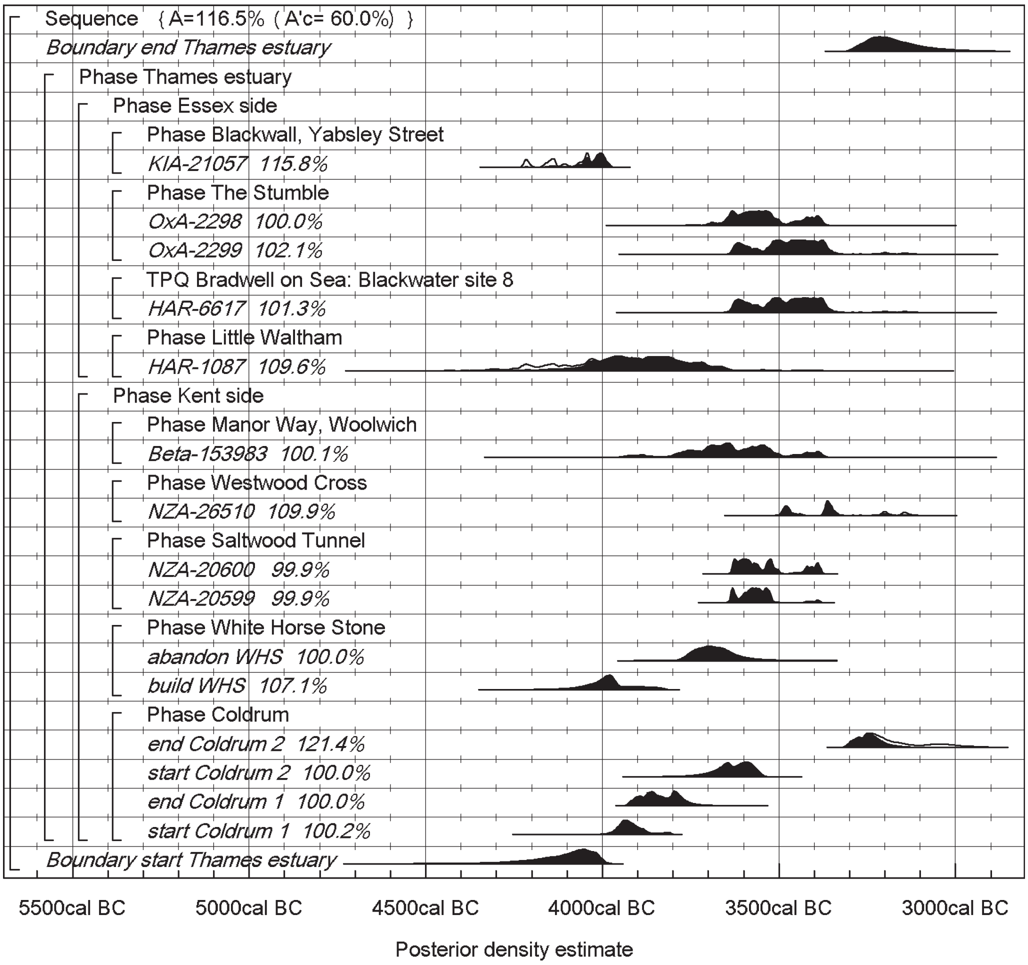


Fig. 14.49. Probability distributions of dates associated with diagnostically early Neolithic material culture from the Thames estuary (excluding those from enclosure sites). The format is the same as for Fig. 14.1. Distributions have been taken from the models defined in Fig. 7.26 (White Horse Stone) and Fig. 7.27 (Coldrum). The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

appearance of the early Neolithic in southern Britain region by region, and then, to the limited extent that the data allow, consider whether different elements of the range were synchronous.

To sum up, the range of Neolithic things and practices employed to determine whether dates and sites are included in these models comprises:

- Cultivated cereals
- Animal domesticates
- Bowl pottery
- Typologically distinctive Neolithic lithics in the form of leaf arrowheads and ground axeheads
- Monuments
- Flint mines
- Rectangular timber buildings.

Regional evidence for the start of Neolithic activity other than enclosures

A model for the date of the early Neolithic in the Greater Thames estuary is shown in Fig. 14.49. Because the purpose of this analysis is to compare the date of the introduction of enclosures with the date of the introduction of other Neolithic things and practices, dates from enclosures are not included in this model. Key parameters from the site-based models for White Horse Stone (Fig. 7.26) and Coldrum (Fig. 7.27) have been included in this model as standardised likelihoods (see Chapter 2.3). This ensures that comparatively well dated sites with a greater number of calibrated radiocarbon dates do not bias the model. This analysis suggests that the Neolithic in the Greater Thames estuary started in *4315−3985 cal BC* (*95% probability*; Fig. 14.49: *start Thames estuary*), probably in *4145−4005 cal BC* (*68% probability*). This estimate is based on 15 likelihoods from nine sites (Table 14.5), associated with a range of Neolithic things and practices (Table 14.6).

The model for the chronology of the early Neolithic in Sussex has been presented in Chapter 5 (Figs 5.32−3). This suggests that the Neolithic in Sussex began in *4065−3815 cal BC* (*95% probability*; Fig. 5.32: *start Sussex Neolithic*), probably in *3990−3855 cal BC* (*68% probability*). This estimate is based on 27 radiocarbon dates from nine sites (Table 14.5), 17 of which are from deep flint mines (Table 14.6).

Table 14.5. Numbers of effective likelihoods included in the regional models for the early Neolithic in southern Britain. Likelihoods may derive from single radiocarbon dates, or from parameters in other models (these distil the information from large numbers of dates into a small number of distributions so that information from well dated sites does not bias the regional model).

Regions	**No. of effective likelihoods**	**No. of effective calibrated radiocarbon dates**	**No. of effective parameters**	**No. of calibrated radiocarbon dates included in models producing effective parameters**	**No. of sites represented**
Thames estuary	15	9	6	32	9
Sussex	27	27	-	-	9
Eastern England	38	29	9	54	26
Middle Thames	28	28	-	-	4
Upper Thames	27	26	1	5	8
N Wessex	24	13	11	62	15
S Wessex	17	13	4	36	10
Cotswolds	35	27	8	69	7
SW Peninsula	24	22	2	4	9
S Wales & Marches	41	41	-	-	14
Totals	**276**	**235**	**41**	**262**	**111**

Figure 6.50 shows the overall structure for the model for the chronology of the early Neolithic in eastern England, with component sections derived from the models shown in Figs 6.47–8. Estimated dates for the construction of some of the monuments have been taken from the site-based models and incorporated into this analysis as likelihoods. Distributions have been taken from the models shown in Figs 6.16 (Haddenham long barrow), Fig. 6.15 (Godmanchester, Rectory Farm), Fig. 6.33 (Etton cursus), and Figs 6.25–7 (Raunds). This analysis suggests that the Neolithic started in eastern England in *3845–3695 cal BC* (*95% probability*; Fig. 6.50: *start eastern Neolithic*), probably in *3800–3730 cal BC* (*68% probability*). This estimate is based on 38 likelihoods derived from 26 sites (Table 14.5), two-thirds of which are associated with Bowl pottery (Table 14.6). It should be noted that the date estimates for the two cursus monuments at Eynesbury and for the Long Mound at Raunds have been excluded from this model for reasons discussed in Chapter 6.

A chronological model for the middle Thames valley is shown in Fig. 14.50. This is based on 28 radiocarbon dates, all of which are associated with Bowl pottery, from four sites. This model suggests that the Neolithic started in the middle Thames valley in *3860–3700 cal BC* (*95% probability*; Fig. 14.50: *start middle Thames Neolithic*), probably in *3810–3735 cal BC* (*68% probability*).

A model for the dating of the early Neolithic in the upper Thames valley is shown in Fig. 14.51. This model includes 27 likelihoods from eight sites, associated with a variety of Neolithic material and structures. This analysis suggests that the Neolithic started in the upper Thames valley in *3915–3740 cal BC* (*95% probability*; Fig. 14.51: *start upper Thames Neolithic*), probably in *3860–3795 cal BC* (*68% probability*).

Figure 14.52 shows the overall structure of a model for the early Neolithic in north Wessex, with component sections showing the dating of long barrows in the Avebury area given in Figs 3.30–1 (although the posterior density estimates shown on these figures are not those relating to this model). Other distributions have been taken from models defined by Wysocki *et al*. (2007, figs 9–11: Fussell's Lodge) and Bayliss *et al*. (2007b, figs 6–7: West Kennet). Overall, the model includes 24 likelihoods from 15 sites (Table 14.5). Fifteen of these likelihoods relate to long barrows, which reflects the amount of research on this monument type in this area (Table 14.6). In fact, the 15 likelihoods from long barrows derive from over 60 radiocarbon measurements and so the modelling approach adopted here alleviates the sampling bias which in actuality is much more severe. This analysis suggests that the Neolithic started in north Wessex in *3930–3665 cal BC* (*95% probability*; Fig. 14.52: *start north Wessex*), probably in *3805–3685 cal BC* (*68% probability*).

A chronological model for the early Neolithic of south Wessex is shown in Fig. 14.53. Distributions for activity on Hambledon Hill before the construction of the enclosure

Table 14.6. Numbers of effective likelihoods included in the regional models for the early Neolithic in southern Britain (excluding enclosures), showing the number of distributions associated with different early Neolithic things and practices. For each region, columns 3 to 10 total more than the number of effective likelihoods in column 2 because distributions may be associated with more than one element.

	No. of effective likelihoods	**Bowl pottery**	**Leaf arrowheads**	**Deep mines**	**Ground axeheads, flakes or fragments**	**Monuments**	**Rectangular structures**	**Cereals**	**Animal domesticates**
Thames estuary	15	9				4	2	6	2
Sussex	27	12	5	17		2			21
Eastern England	38	28	6		4	16		7	9
Middle Thames	28	27	14		18	5		13	27
Upper Thames	27	14	1		5	5	4	16	15
North Wessex	24	12	6		5	19		1	19
South Wessex	17	13	5		4	8		7	15
Cotswolds	35	29	21		13	29		4	34
SW peninsula	24	23	4		3	2	1	4	4
S Wales & Marches	41	28	10		9	28		8	16
Totals	**276**	**195**	**72**	**17**	**61**	**119**	**7**	**66**	**162**

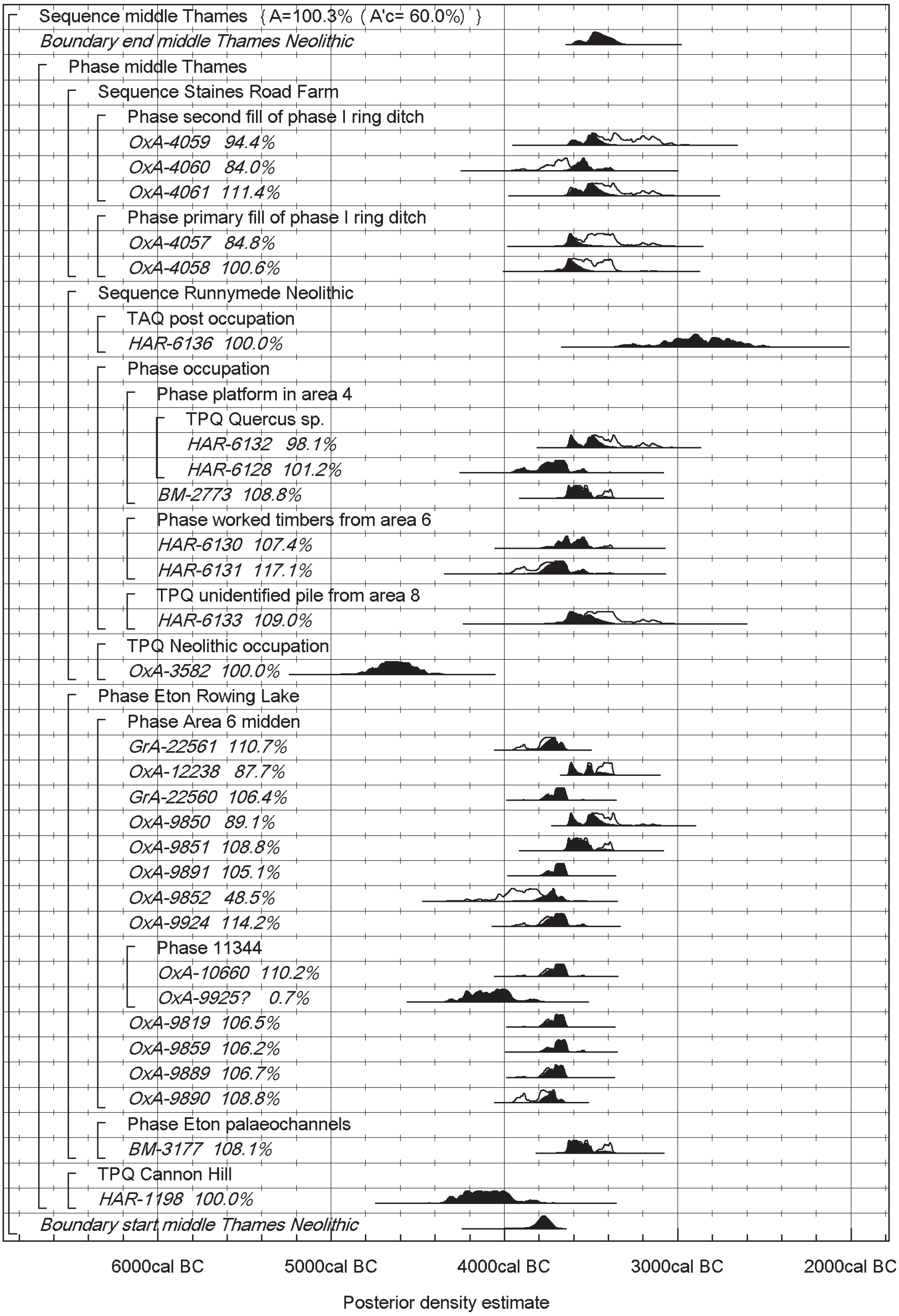


Fig. 14.50. Probability distributions of dates associated with diagnostically early Neolithic material culture from the middle Thames valley (excluding those from enclosure sites). The format is the same as for Fig. 14.1. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

complexes have been taken from the model defined in Figs 4.7–13. The date for the early Neolithic hearth in the Fir Tree Field shaft is taken from the model defined in Fig. 4.21, and the dates for the Maiden Castle long mound are derived from the model defined in Figs 4.34–7. Overall, the model includes 17 likelihoods, associated with a range of Neolithic practices, from 10 sites (Tables 14.5–6). This model suggests that the Neolithic started in south Wessex in *4065–3705 cal BC* (*95% probability*; Fig. 14.53: *start south Wessex*), probably in *3905–3735 cal BC* (*68% probability*).

We have presented a model for the chronology of

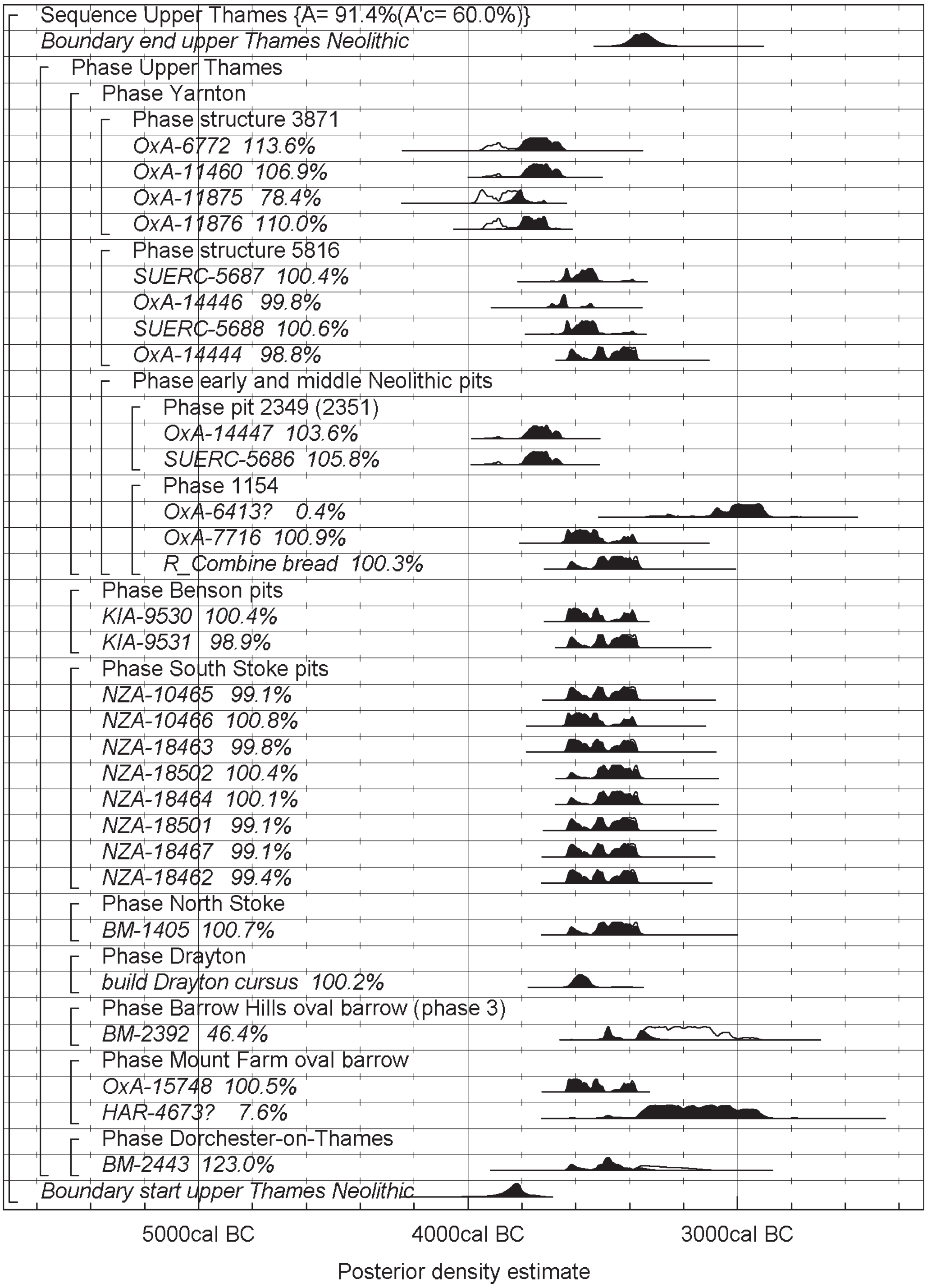


Fig. 14.51. Probability distributions of dates associated with diagnostically early Neolithic material culture from the upper Thames valley (excluding those from enclosure sites). The format is the same as for Fig. 14.1. The distribution for the Drayton cursus has been taken from the model defined in Fig. 8.30. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

the early Neolithic in the Cotswolds in Chapter 9 (Figs 9.29–30). This includes 35 likelihoods – 27 radiocarbon dates and parameters for the start and end of pre-cairn activity, and the use of the cairns and barrows at Ascott-under-Wychwood and Hazleton. These parameters have been taken from the models defined in Bayliss *et al.* (2007c, figs 5–7) and Meadows *et al*. (2007, figs 7–8). Twenty-nine of the likelihoods are associated with long barrows, despite the incorporation of parameters from Ascott-under-Wychwood and Hazleton which distil 69 radiocarbon dates into eight distributions. Unfortunately, no other Cotswold long cairn has enough radiocarbon dates for this approach to be practical, although collectively these dates are sufficiently numerous to unbalance the model. Of the 35 likelihoods for the model for this region, 29 are related to long cairns and barrows (Table 14.6). Nonetheless, on the

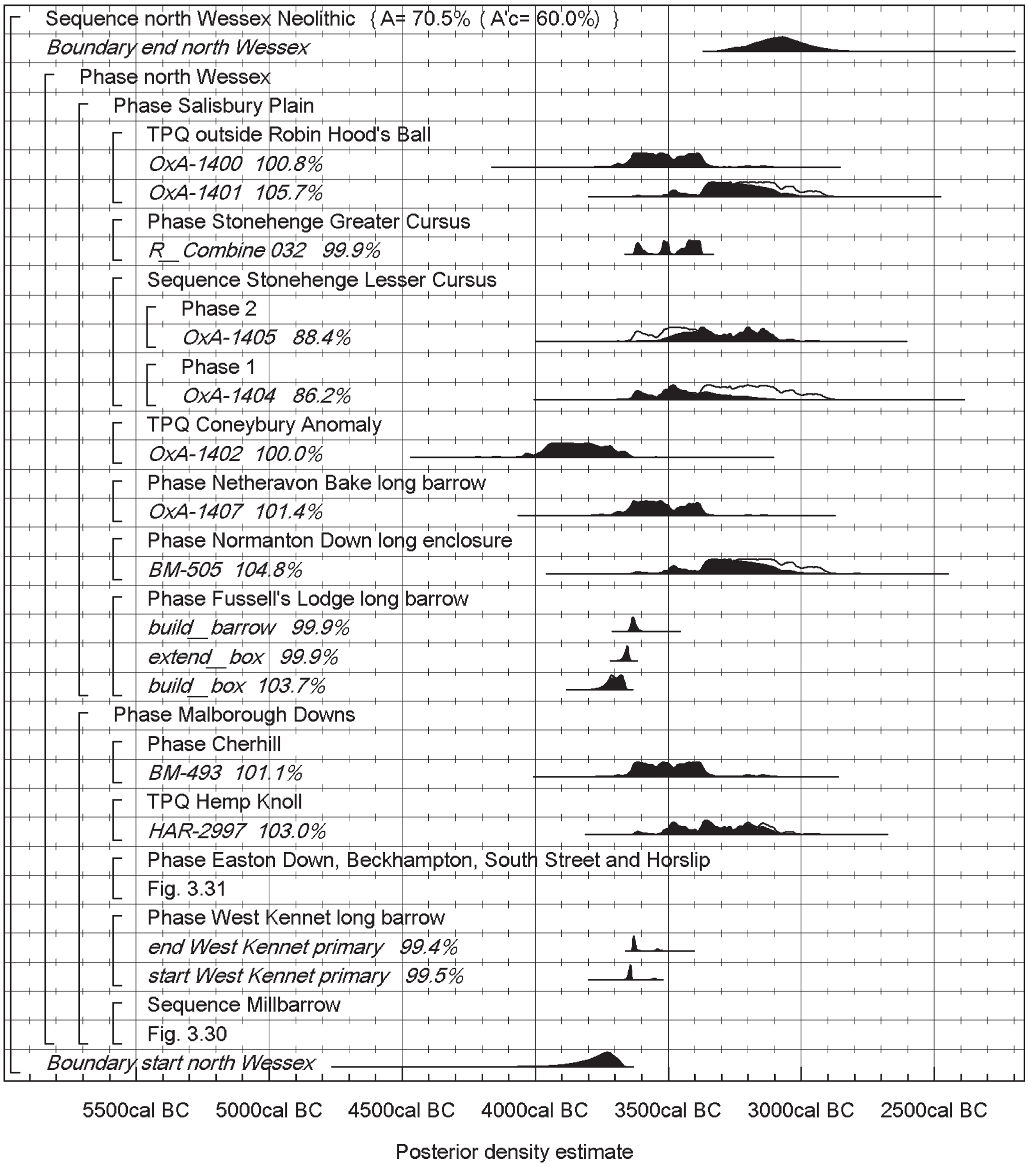


Fig. 14.52. Probability distributions of dates associated with diagnostically early Neolithic material culture from north Wessex (excluding those from enclosure sites). The format is the same as for Fig. 14.1. The structures of the components of this model relating to long barrows in the Avebury area are given in Figs 3.30–1 (although the posterior density estimates shown on these figures are not those relating to this model). Distributions have been taken from the models defined by Wysocki et al. *(2007, fig. 10) (Fussell's Lodge) and Bayliss* et al. *(2007b, fig. 6) (West Kennet). The large square brackets down the left-hand side of these diagrams, along with the OxCal keywords, define the overall model exactly.*

basis of the data currently available, our model suggests that the Neolithic in the Cotswolds began in *4035−3845 cal BC* (*95% probability*; Fig. 9.29: *start Cotswold Neolithic*), probably in *3985−3890 cal BC* (*68% probability*).

Figure 10.30 shows the chronological model for the early Neolithic in the south-west. This includes 24 likelihoods, as it is the boundaries for the use of Broadsands that are effective in the analysis. These distributions derive from nine sites. All are associated with the use of Bowl pottery. This model suggests that the Neolithic in the south-west peninsula began in *3940−3735 cal BC* (*95% probability*; Fig. 10.30: *start Neolithic settlement*), probably in *3855−3765 cal BC* (*68% probability*).

Finally, our model for the chronology of the early Neolithic of south Wales and the Marches is shown in Figs 11.10−11. It includes 41 radiocarbon dates, 28 of which are associated with long cairns, from 14 sites. This model suggests that the early Neolithic in this area began in *3765−3655 cal BC* (*95% probability*; Fig. 11.10: *start S Wales & Marches*), probably in *3725−3675 cal BC* (*68% probability*).

A model for the start of the Neolithic in the ten regions considered within southern Britain is shown in Fig. 14.54. This analysis treats the appearance of Neolithic activity over the whole of southern Britain as a process which once started continued until all areas had adopted at least one element of the Neolithic assemblage. It should be noted that this does not exclude a locally patchy adoption of Neolithic

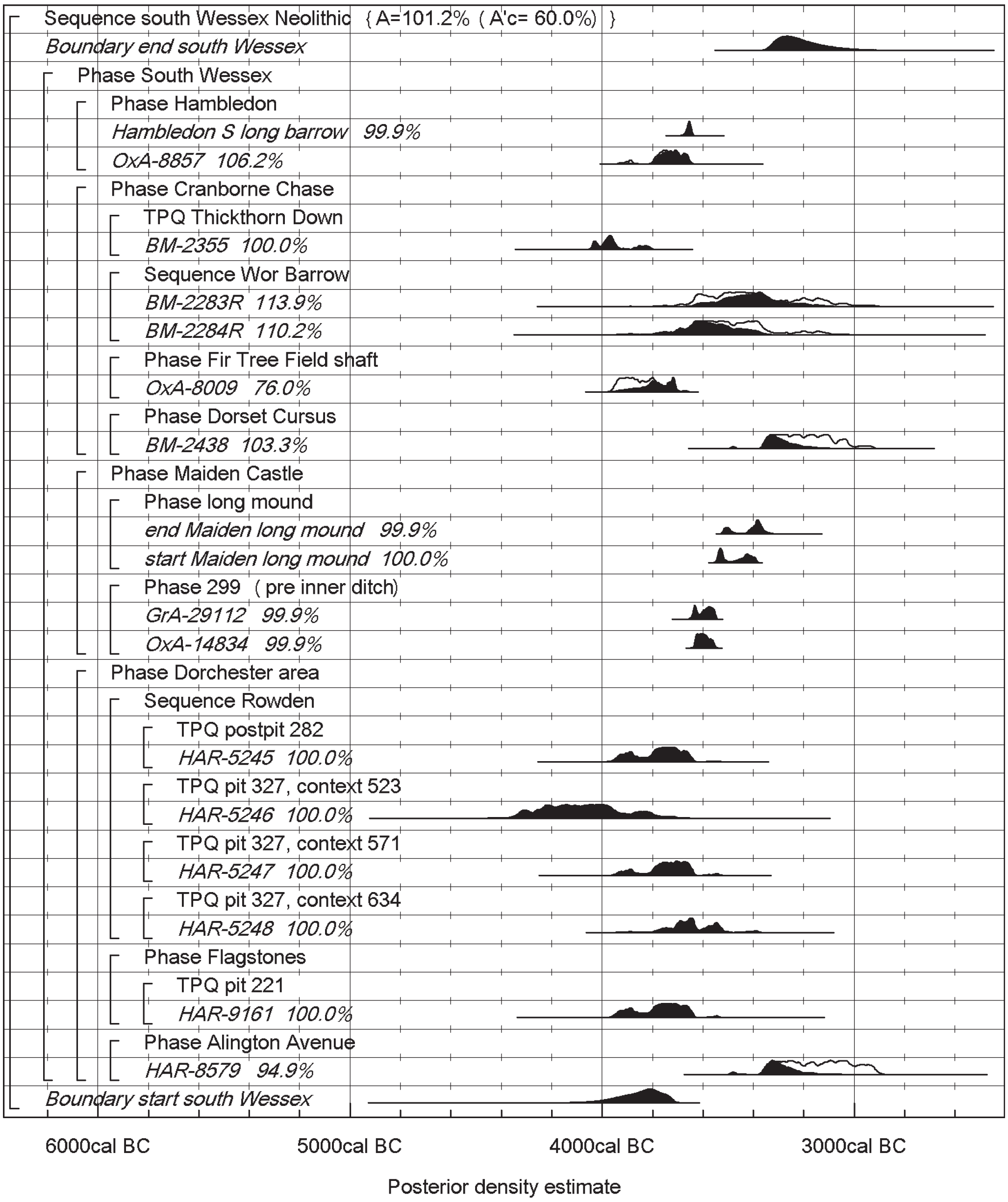


Fig. 14.53. Probability distributions of dates associated with diagnostically early Neolithic material culture from south Wessex (excluding those from enclosure sites). The format is the same as for Fig. 14.1. Distributions have been taken from the models defined by Figs 4.7–13 (Hambledon Hill), Fig. 4.21 (Fir Tree Field shaft) and Figs 4.41–5 (Maiden Castle). The large square brackets down the left-hand side of these diagrams, along with the OxCal keywords, define the overall model exactly.

things and practices. The regional estimates are based on a total of 276 likelihoods from 111 sites (Table 14.5).

Seventy percent of these distributions are associated with more than one element of the range of Neolithic things and practices (Fig. 14.55). This is almost certainly an underestimate since a number are from sites which are not yet fully published, so that the final tally of associations may be fuller. The three most frequent associations are with Bowl pottery (71%), animal domesticates (59%) and monuments (43%). Only a small proportion of dates (less than 7%) are associated solely with cultivation and animal husbandry without other components, and this may be reduced following the full publication of some of the sites concerned. When the composition of the sample is considered by region (Table 14.6) some significant differences appear. Sussex is the only area in the sample where there are dates from deep flint mines. The samples from north Wessex and the Cotswolds are heavily biased by dates from monuments, particularly long barrows and cairns. The samples from the middle Thames and the south-west peninsula are biased by disproportionate numbers of dates associated with Bowl pottery. In other areas, the samples are more varied. These differences may have a significant effect on the date estimates if different elements of the diagnostic Neolithic assemblage did not all appear at the same time.

Figure 14.54 suggests that the first appearance of Neolithic material and structures did not occur at the

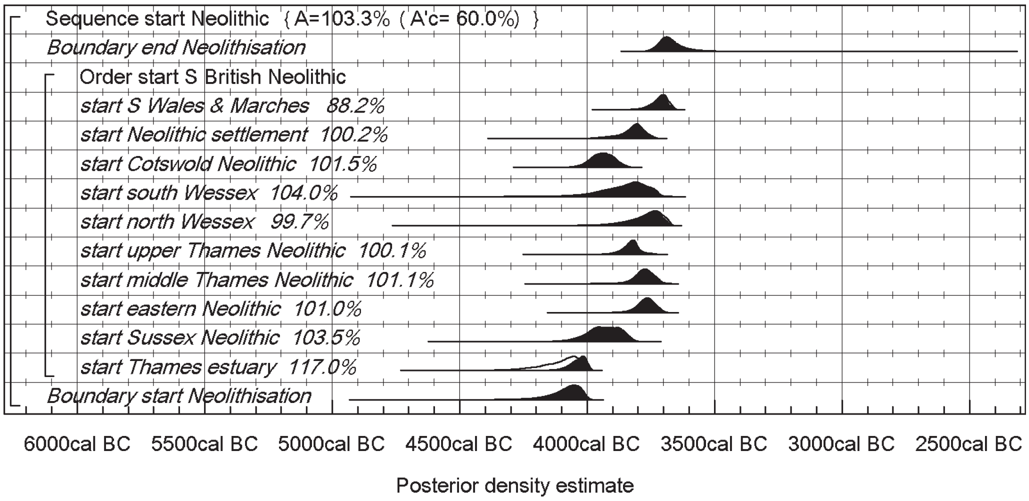


Fig. 14.54. Chronological model for the first Neolithic activity in southern Britain. Distributions for different regions have been taken from the models defined in Figs 14.49, 5.32–3, 6.50 and 6.47–8, 14.50, 14.51, 14.52 and 3.30–1, 14.53, 9.29–30, 10.30, and 11.10–11. The distribution 'start Neolithic settlement' is that for the south-west peninsula. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

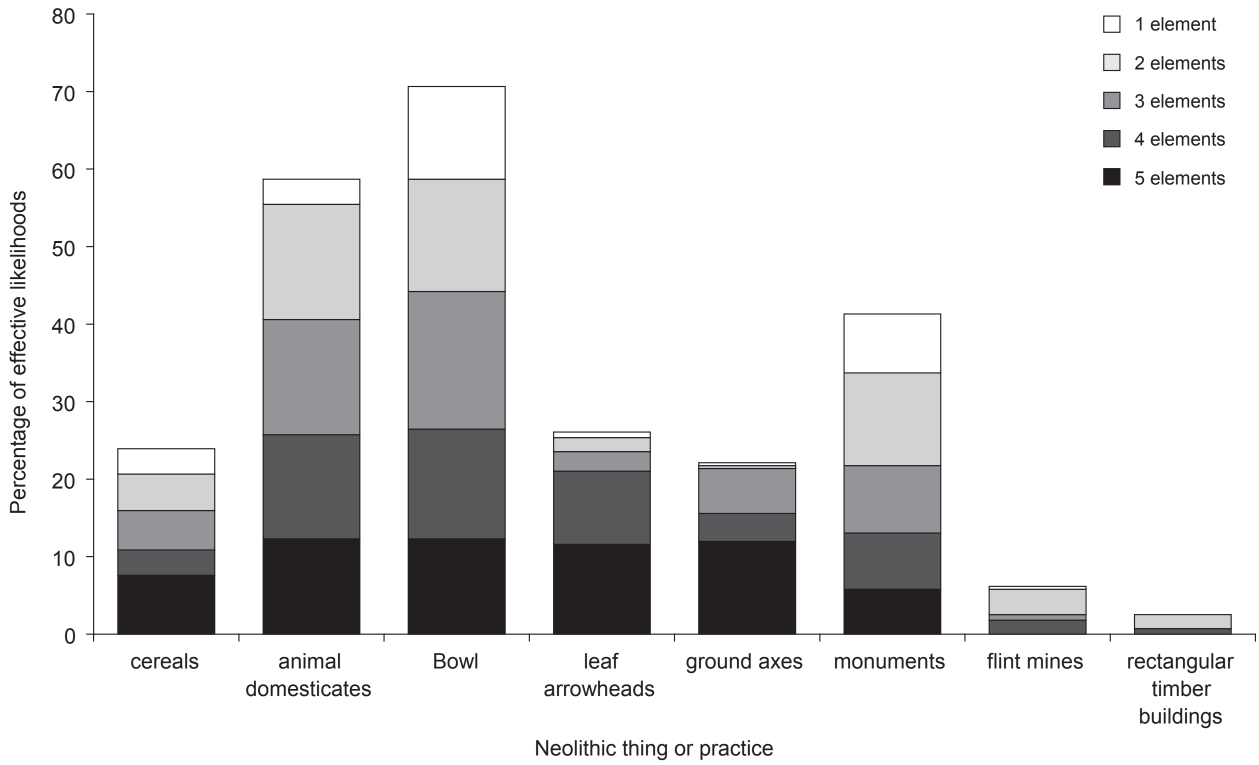


Fig. 14.55. Bar chart showing the proportions of the likelihoods (n=276) associated with different Neolithic things and practices included in the regional models for the early Neolithic of southern Britain.

same time across southern Britain. It is *91% probable* that the first diagnostic Neolithic activity in southern Britain occurred in the Greater Thames estuary. After this initial occurrence, Neolithic activity then appears, probably in the 40th century cal BC, in Sussex and the Cotswolds. In other areas, the first manifestation of diagnostic Neolithic things and practices is later: in the upper Thames valley, perhaps during the 39th century cal BC, and in a wide swathe across eastern England, the middle Thames valley, north and south Wessex and the south-west peninsula, over the following century or so. The first Neolithic activity in south Wales and the Marches does not seem to have appeared until the generations around 3700 cal BC.

This model suggests that it took an extended period for Neolithic practices to spread across southern Britain. It seems that it took *265−640 years* (*95% probability*; Fig. 14.56: *period of Neolithisation*), probably *310−475 years* (*68% probability*), from their first occurrence, probably

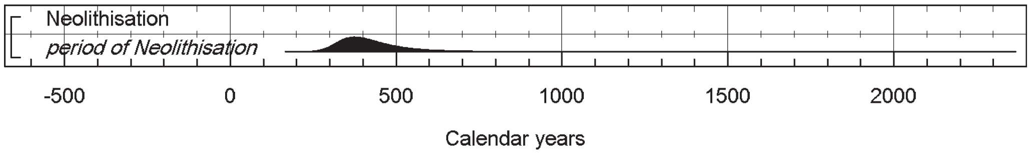


Fig. 14.56. The period during which the first Neolithic activity appeared across southern Britain, derived from the model shown in Fig. 14.54.

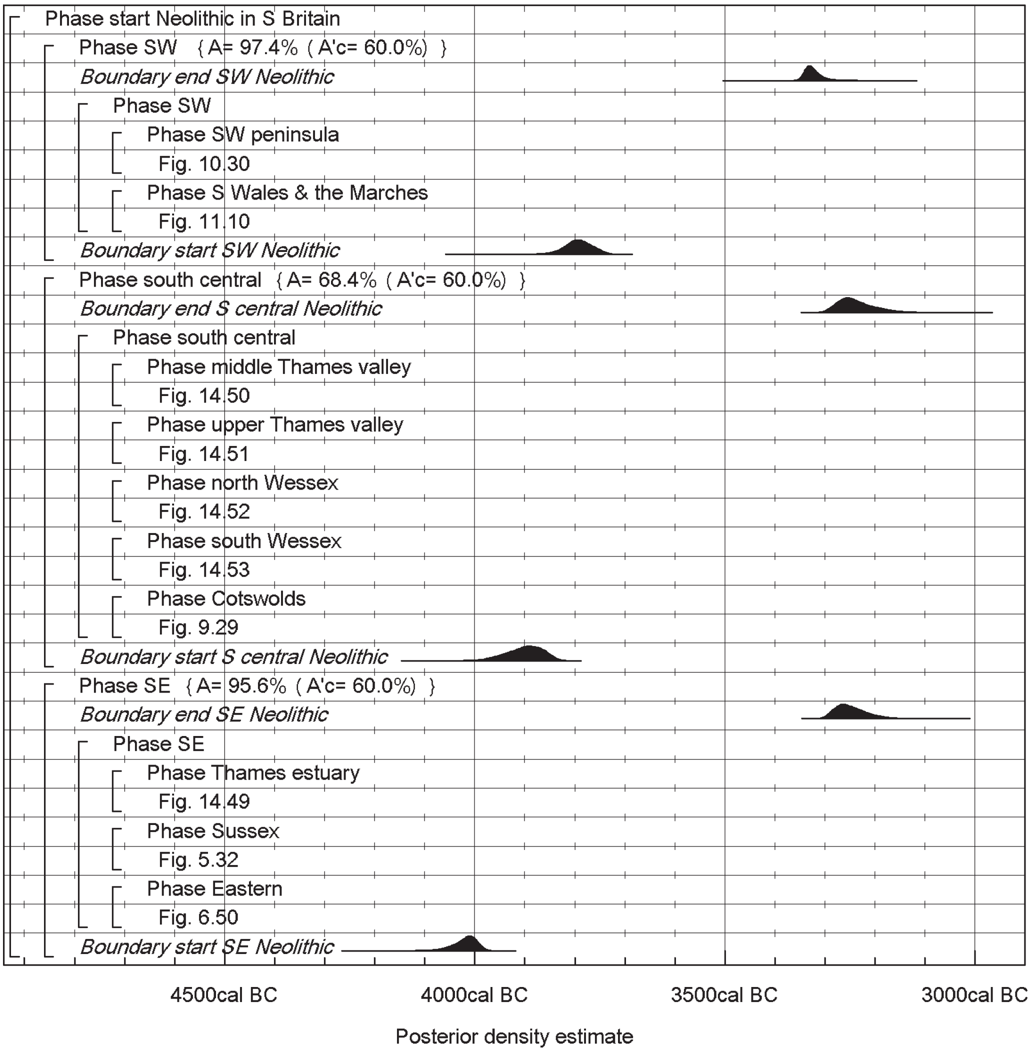


Fig. 14.57. Chronological model for the date of the early Neolithic in different areas of southern Britain. Component sections are shown between the uniform phase boundaries of the models defined in Figs 10.30, 11.10, 14.50–3, 9.29, 14.49, 5.32, and 6.50 (although the posterior density estimates shown on these figures are not those relating to this model). The large square brackets down the left-hand side of these diagrams, along with the OxCal keywords, define the overall model exactly.

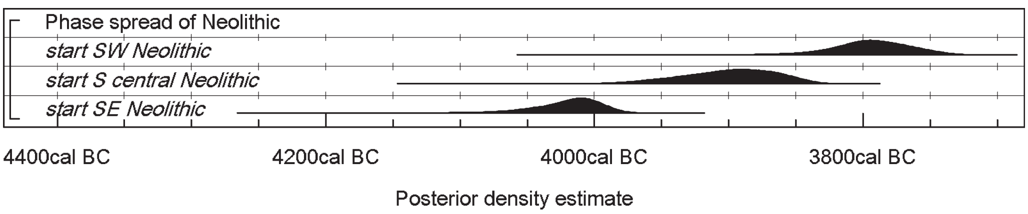


Fig. 14.58. Probability distributions of dates for the start of the early Neolithic in different areas of southern Britain, derived from the models shown in Fig. 14.57.

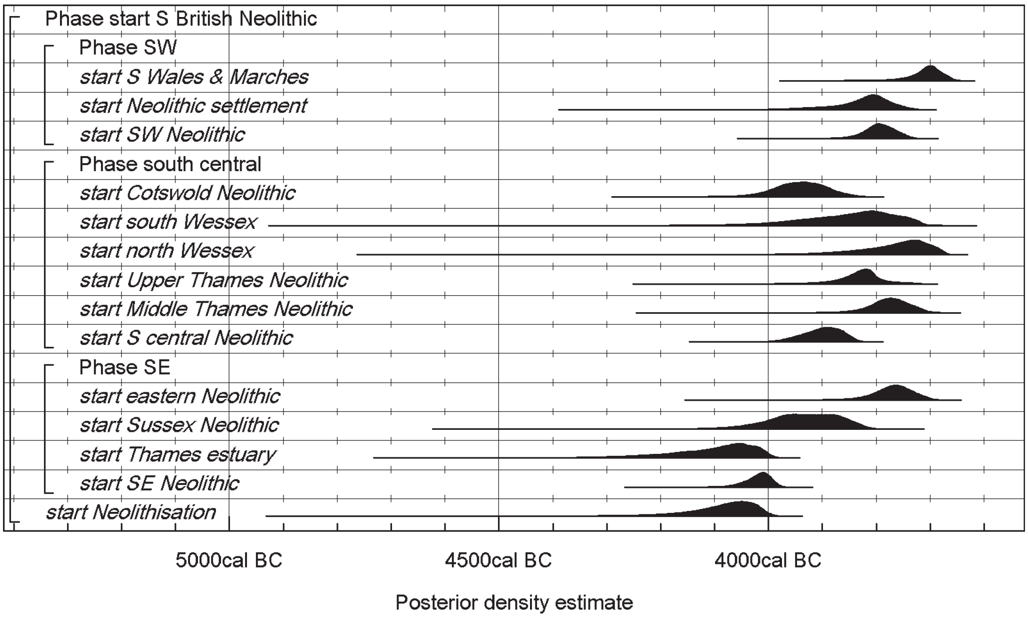


Fig. 14.59. Probability distributions of dates for the start of the early Neolithic in different areas of southern Britain, derived from the model shown in Fig. 14.57, and for the first Neolithic in the smaller regions utilised in the model shown in Fig. 14.54.

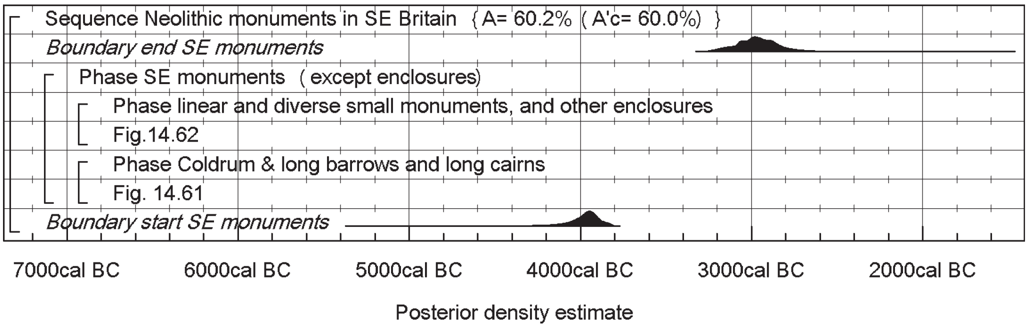


Fig. 14.60. Overall structure of the chronological model for early Neolithic monuments in south-east England. The component sections of this model are shown in detail in Figs 14.61–2. The large square brackets down the left-hand side of Figs 14.60–2, along with the OxCal keywords, define the overall model exactly.

in the Greater Thames estuary (*91% probable*), until their final appearance, very possibly in south Wales and the Marches (*61% probable).* This process began in *4235–3985 cal BC (95% probability*; Fig. 14.54: *start Neolithisation)*, probably in *4115–4010 cal BC (68% probability)* and was complete by *3765–3535 cal BC (95% probability*; Fig. 14.54: *end Neolithisation)*, probably by *3730–3635 cal BC (68% probability).*

There are hints that the pace of this process may not have been constant throughout this period. In the first two centuries, Neolithic activity appears in only three regions; whereas in the next two centuries, it appears over the other seven. Once the initial idea was established, did the pace of its adoption increase? This raises two thorny questions.

The first is the question of foci or points of appearance. One possibility is that there was a single focus of first appearance, very probably in the Greater Thames estuary, which stood at the head of a subsequent process of spread outwards across southern Britain, probably next around 100 km into Sussex and more than 200 km into the Cotswolds. Another possibility, however, is that there were multiple foci or points of appearance, in Kent, Sussex and the Cotswolds, though not necessarily all at exactly the same time. Two of these areas are coastal and south-eastern, close to likely continental sources of contact or inspiration. But in this version the first appearance of things Neolithic in the Cotswolds is also early, and at some geographical remove from Kent and Sussex; around it are other areas where numbers of sites have been dated, although none appear as early as in the Cotswolds. Could this imply another point of origin by another route of introduction, say around the south-west peninsula and up the Severn estuary, or over shorter distances, up the rivers of Wessex? The difficulty in both cases is the lack of comparably early material in the areas between the Cotswolds and points south. We could perhaps get round this difficulty in two ways. We might invoke the regional gaps which we have not investigated (see above) as the possible way into the Cotswolds: thus along the Surrey and Berkshire Downs and swiftly across the upper Thames, with no visible trace left behind. Or

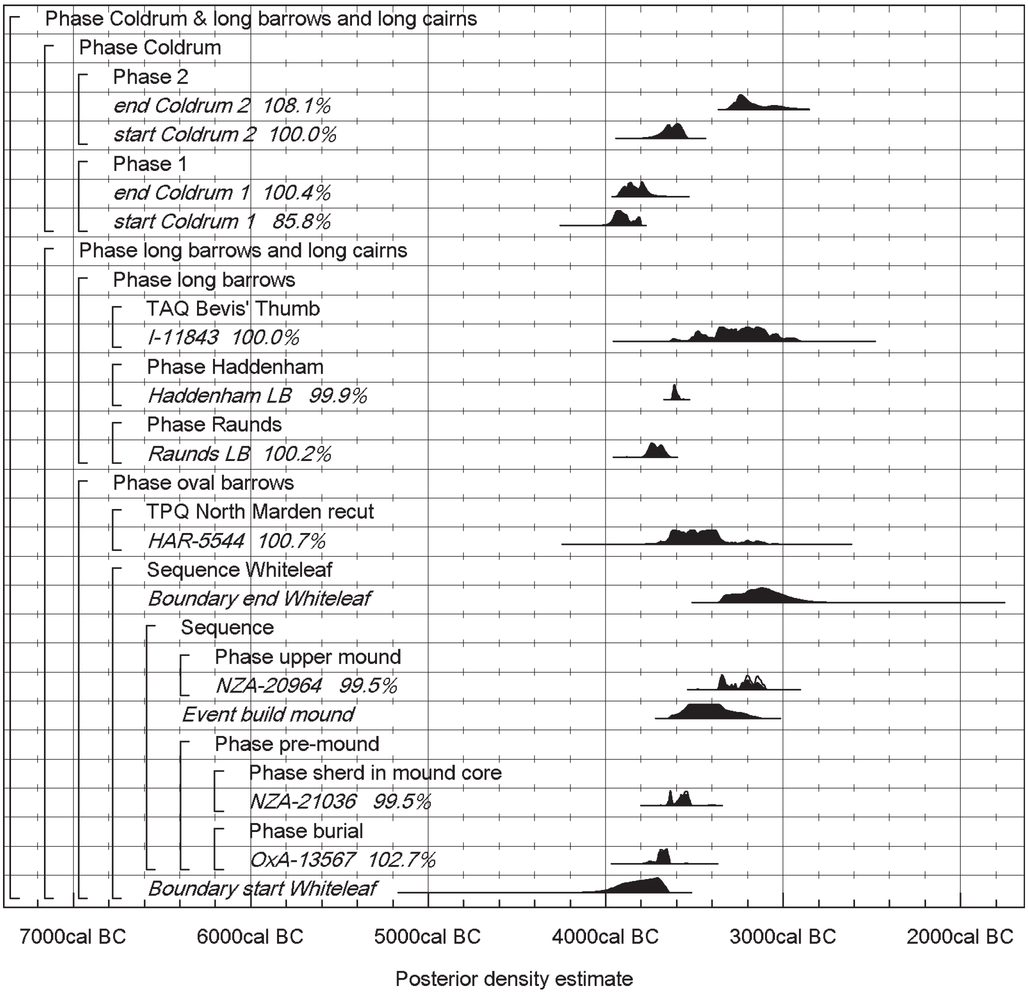


Fig. 14.61. Probability distributions of dates from Coldrum and long and oval barrows in south-east England. The format is identical to that of Fig. 14.1. Distributions have been taken from models defined in Fig. 7.27 (Coldrum), Figs 6.16–17 (Haddenham), and Figs 6.25–7 (Raunds). The overall structure of this model is shown in Fig. 14.60, and its other component in Fig. 14.62.

we could have recourse to that generalising theory about colonisation which notes the frequent recurrence of highly targeted moves; people (and normally not whole cultures) often colonise along reconnoitred or scouted routes, seeking to reach predetermined destinations and no others (e.g. Anthony 1990; and see further Chapter 15).

The second question is whether the models for the chronology of the early Neolithic are reliable. Compare Fig. 14.54, which shows estimates for the start of the Neolithic in different regions of southern Britain, with Fig. 14.15, which gives the date of the first dated enclosure in each region. The tick marks tell a tale – in Fig. 14.15 they mark generations, whereas in Fig. 14.54 they mark centuries. This project was designed to date causewayed and other enclosures. We therefore have reliable dates for an appreciable proportion of the known sites of that kind. In contrast, we have gathered as many as we could of the existing radiocarbon dates on early Neolithic contexts other than enclosures. This sample is neither designed nor random, but opportunistic. It depends upon the foci of past research, on the scale and circumstance of recent development, and on the ability of contract archaeologists in a given region to obtain radiocarbon dates. This is vividly illustrated by the model for the early Neolithic in the Greater Thames estuary (Fig. 14.49), where 37 of the 41 radiocarbon dates available have been obtained in the last five years! New information may change the picture presented here substantially.

Not only is the amount of information variable, but so too are its quality and its reflection of the types of early Neolithic practice present in a region. For example, all the radiocarbon dates included in the model for Sussex (Figs 5.32–3) were obtained before 1990. Among regions where the sample is dominated by dates from monuments (Table 14.6), there are both early date estimates for the first Neolithic, as in the Cotswolds, and late ones, as in south Wales and the Marches. In contrast, both regions where the samples are biased by disproportionate numbers of dates from pits and middens containing Bowl pottery, the middle Thames valley and the south-west peninsula, have produced later date estimates for the start of the Neolithic. In both cases, dates are available on samples

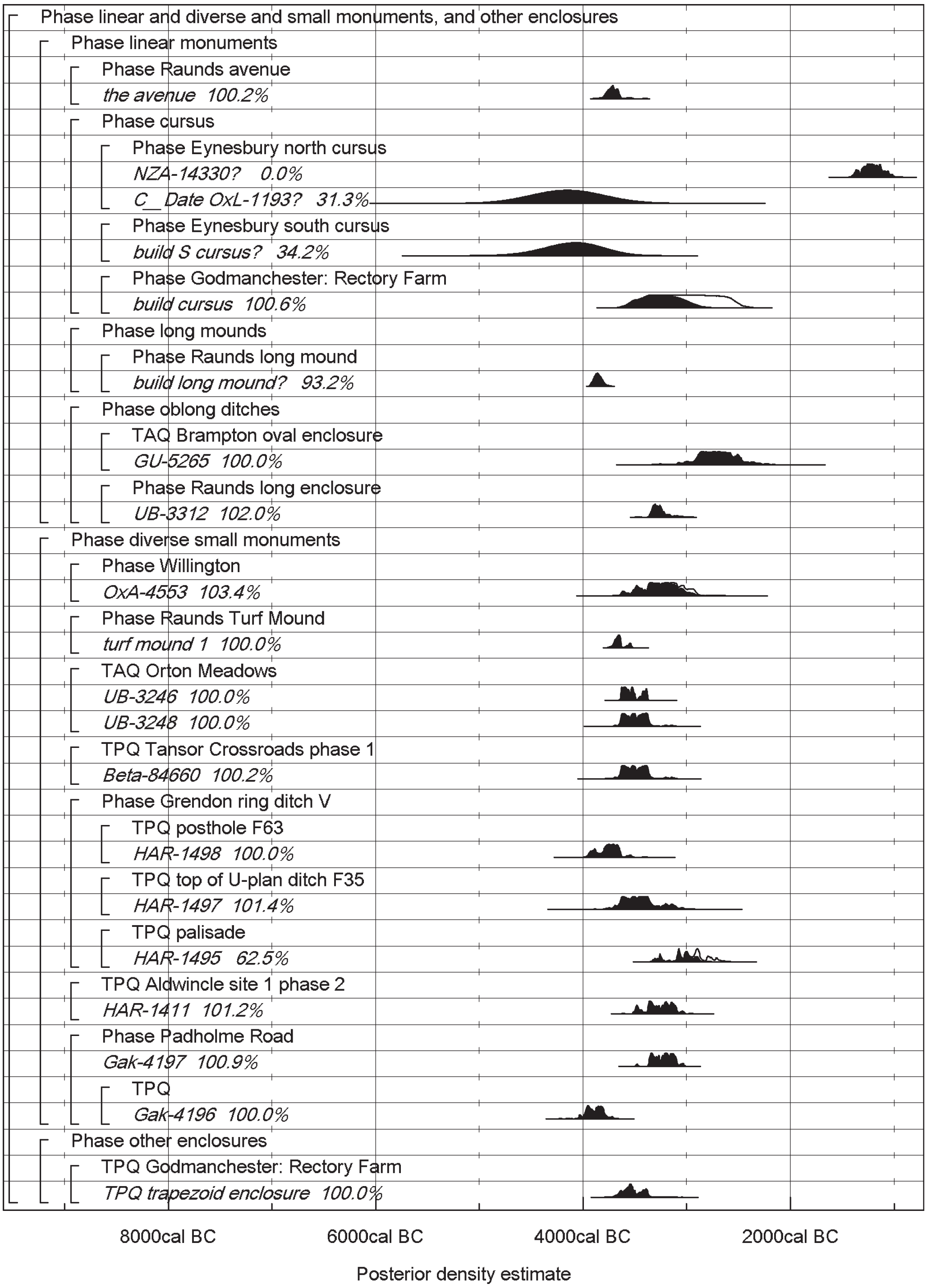


Fig. 14.62. Probability distributions of dates from linear and diverse small monuments, and other enclosures in south-east England. The format is identical to that of Fig. 14.1. Distributions have been taken from models defined in Fig. 6.13 (Eynesbury), Fig. 6.15 (Godmanchester, Rectory Farm) and Figs 6.25–7 (Raunds). The overall structure of this model is shown in Fig. 14.60, and its other component in Fig. 14.61.

associated with a range of Bowl pottery styles – but was there Neolithic activity before pottery was current? If so, it has not been dated. This would be surprising, at least in the south-west peninsula where a comparatively large number of radiocarbon dates have been obtained recently from a range of contexts both with and without pottery. In Sussex, pits and other small-scale activity are poorly represented, but a number of the flint mines have provided consistently early dates.

It is clear that the models for the chronology of the early Neolithic presented in this chapter are not as reliable as those relating to enclosures. To improve this position, first we need precise dating for a much larger sample of sites, where possible exploiting the potential of

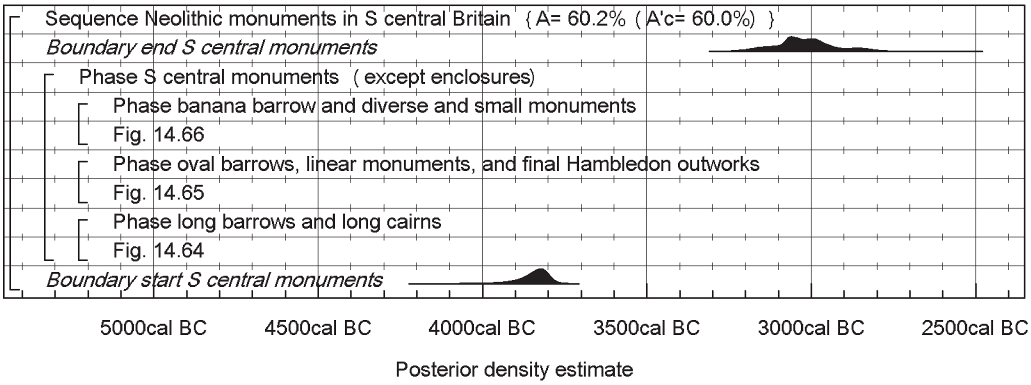


Fig. 14.63. Overall structure of chronological model for early Neolithic monuments in south-central England. The component sections of this model are shown in detail in Figs 14.64–6. The large square brackets down the left-hand side of Figs 14.63–6, along with the OxCal keywords, define the overall model exactly.

stratigraphy to provide informative prior information to constrain our models. This makes our wider chronologies much less reliant on the validity of our uninformative prior information (see Chapter 2.4.1 and 2.8). Second, new statistical methods currently in development may allow us to unpack the dating of the range of Neolithic activity considered here more reliably and produce more sophisticated spatio-temporal models (Karlsberg 2006; Blackwell and Buck 2003).

Meanwhile, we can build a number of alternative models to investigate the sensitivity of our chronologies for the early Neolithic in southern Britain to archaeological and mathematical assumptions.

First, we can aggregate the regions into larger areas, in order to provide a larger sample of data in each area, smoothing out possible idiosyncracies in the available regional data sets. We have aggregated the Greater Thames estuary, Sussex and eastern England (as south-east England); the middle Thames, the upper Thames, north Wessex, south Wessex and the Cotswolds (as south-central England); and the south-west peninsula and south Wales and the Marches (as south-west Britain). The chronological models for the early Neolithic in these areas are defined in Fig. 14.57. The date estimates for the first appearance of Neolithic things and practices are shown in Fig. 14.58. A simpler chronological progression is apparent. According to this model, it is *99% probable* that Neolithic things and practices first appeared in south-east England, followed by their appearance in south-central England, and then in south-west Britain. The spread of the phenomenon appears to occur at a relatively constant pace.

The estimates for the start of the Neolithic in these wider areas are compared with those for the smaller regions previously discussed in Fig. 14.59. The question is whether the area-based models are more reliable because they are based on a larger and more robust sample of data, with biases in the data smoothed out, or whether these larger areas mask subtleties in the process of Neolithisation. In Fig. 14.59, two potential variations stand out particularly. Does the start of the Neolithic in eastern England appear late, compared with the Thames estuary and Sussex, because of, say, a paucity of dates from Suffolk? By contrast, does the estimate for the start of the Neolithic in the Cotswolds appear early, compared with adjacent regions, because of the imbalance in dated contexts, which have been heavily biased towards long cairns and barrows? It can be noted that the estimate for the late start of the Neolithic in south Wales and the Marches, compared for example with the start in the adjacent south-west peninsula of England, also includes numerous samples from long cairns. At this stage of research, it is simply impossible to resolve these questions, and we therefore cannot say whether these variations are anomalies to be explained away or real patterns in a complex process of staggered starts.

We can now assess whether different elements of the assemblage of Neolithic things and practices appeared synchronously in the areas of southern Britain which we have just considered. Only for monuments and pottery are there sufficient data for independent analysis. Figures 14.60–2 define the model for the appearance of monuments (excluding causewayed enclosures) in south-east England. Figures 14.63–6 define the model for the appearance of monuments (excluding causewayed enclosures) in south-central England, and Figure 14.67 defines the model for the appearance of monuments (excluding causewayed and stone-walled enclosures) in south-west Britain. Figures 14.68–71 define the model for the chronology of Bowl pottery in south-east England; Figures 14.72–6 define a similar model for south-central England; and Figures 14.77–9 define the model for the currency of Bowl pottery in south-west Britain.

Figure 14.80 shows our estimates for the start of all Neolithic activity in each area (see Fig. 14.58), compared with the estimates for the first Neolithic monument and the first pottery in each area. All these models exclude the data from causewayed and tor enclosures, but they are not statistically independent. Our models for the start of the Neolithic (Fig. 14.57) include likelihoods associated with monuments, with pottery, and with other Neolithic activity (Table 14.6). Our models for early Neolithic monumentality include all likelihoods relating to monuments, including those which also have associated pottery. Equally, our models for the currency of Bowl pottery include all dates associated with this ceramic tradition, even those from

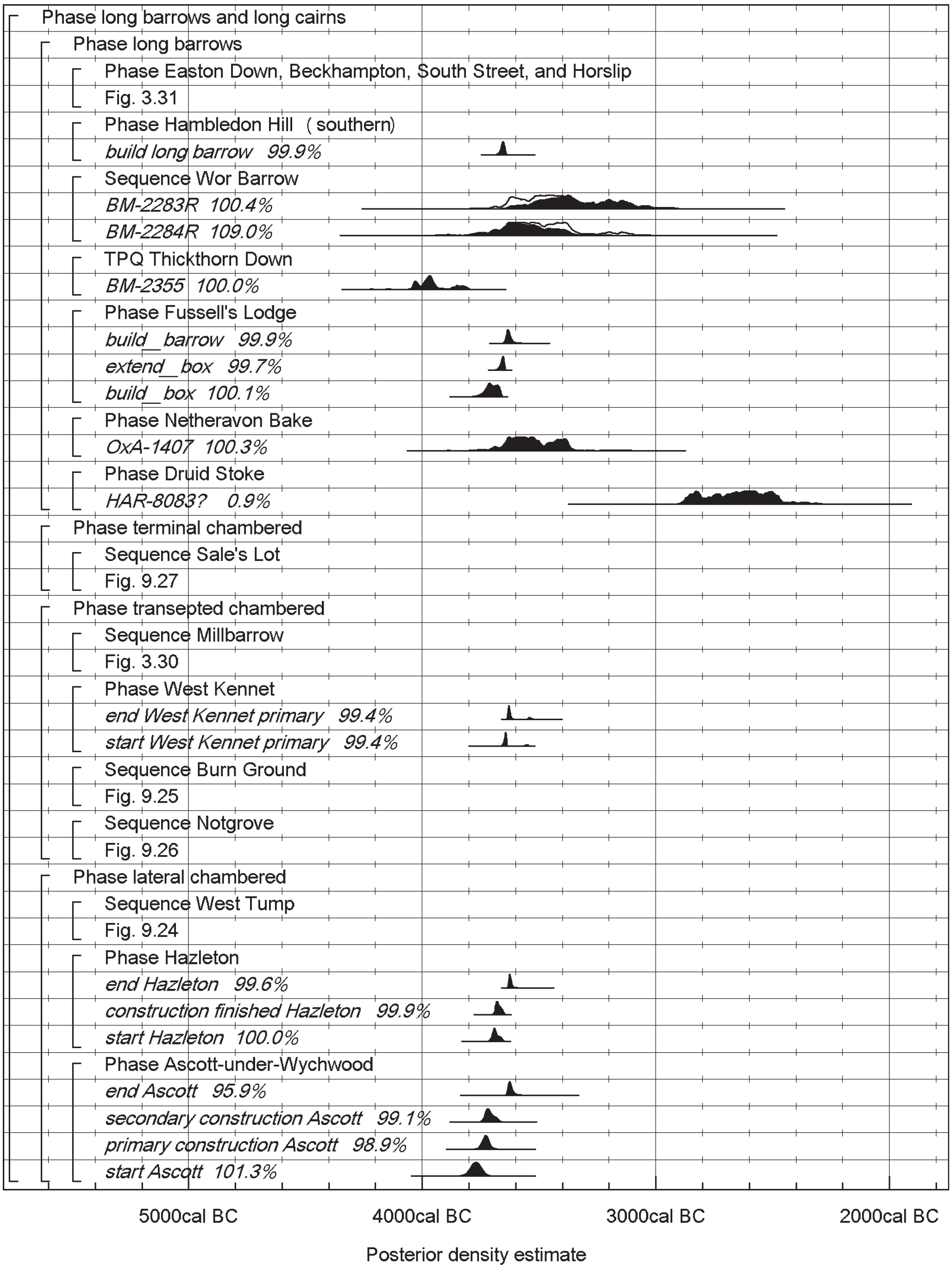


Fig. 14.64. Probability distributions of dates from long barrows and long cairns in south-central England. The format is identical to that of Fig. 14.1. The structure of the component sections of this component are shown in Figs 3.30–1 (long barrows in the Avebury area) and Figs 9.24–7 (West Tump, Burn Ground, Notgrove, and Sale's Lot) (although the posterior density estimates shown on these figures are not those relating to this model). Other distributions have been taken from models defined in Figs 4.7–13 (Hambledon Hill), Bayliss et al. *2007b, fig 6 (West Kennet), Meadows* et al. *2007, figs 6–9 (Hazleton), and Bayliss* et al. *2007c, figs 3 and 5–7 (Ascott-under-Wychwood). The overall structure of this model is shown in Fig. 14.63, and its other components in Figs 14.65–6.*

monuments. In some cases, however, when we divide dates into smaller categories, we no longer have sufficient data to assess realistically the scatter on the assemblage of dates. So, for example, our posterior density estimate for the start of monuments in south-west Britain (Fig. 14.67: *start SW monuments*) has an unrealistically long early tail.

We have seen that the first Neolithic in south-east Britain appeared in *4075–3975 cal BC* (*95% probability*; Fig. 14.57: *start SE Neolithic*), probably in *4035–3990 cal BC* (*68% probability*). The first monumental construction appeared in this area in *4155–3815 cal BC* (*95% probability*; Fig. 14.60: *start SE monuments*), probably in *4030–3885 cal BC* (*68% probability*). The first pottery appeared in south-east England in *4105–3975 cal BC* (*95% probability*; Fig.

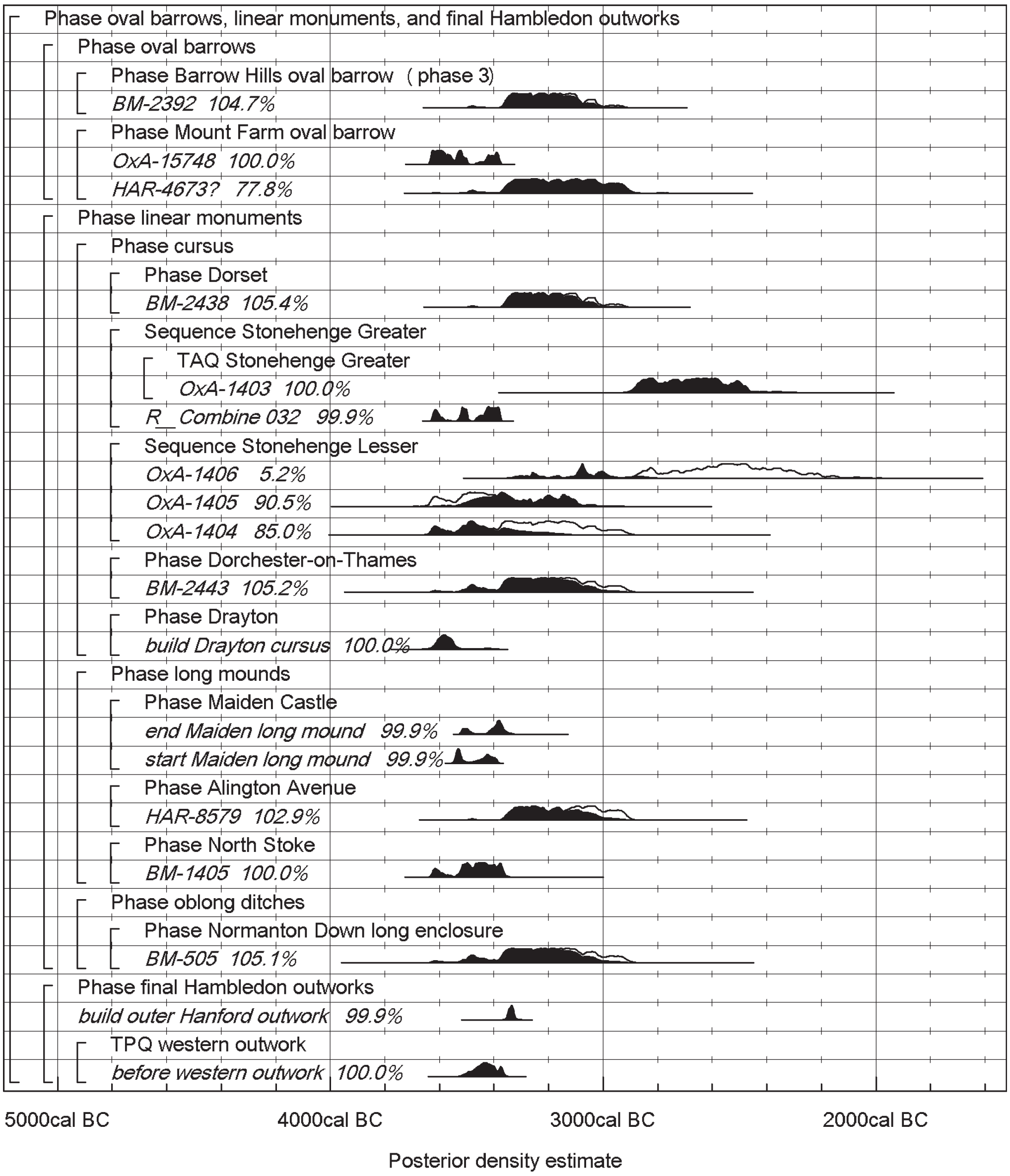


Fig. 14.65. Probability distributions of dates from oval barrows, linear monuments, and the final Hambledon outworks in south-central England. The format is identical to that of Fig. 14.1. Distributions have been taken from the model defined in Figs 4.7–13 (Hambledon Hill). The overall structure of this model is shown in Fig. 14.63, and its other components in Figs 14.64 and 14.66.

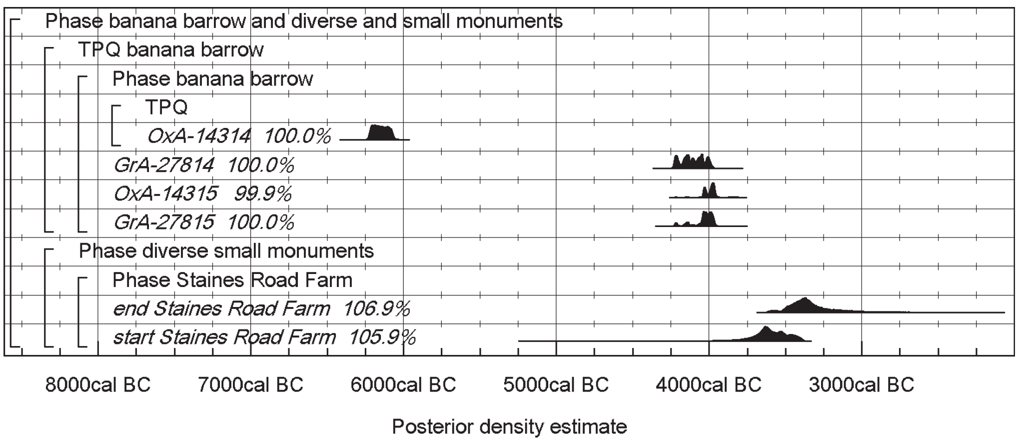


Fig. 14.66. Probability distributions of dates from the banana barrow and diverse small monuments in south-central England. The format is identical to that of Fig. 14.1. Distributions have been taken from model defined in Fig. 8.7 (Staines Road Farm). The overall structure of this model is shown in Fig. 14.63, and its other components in Figs 14.64–5.

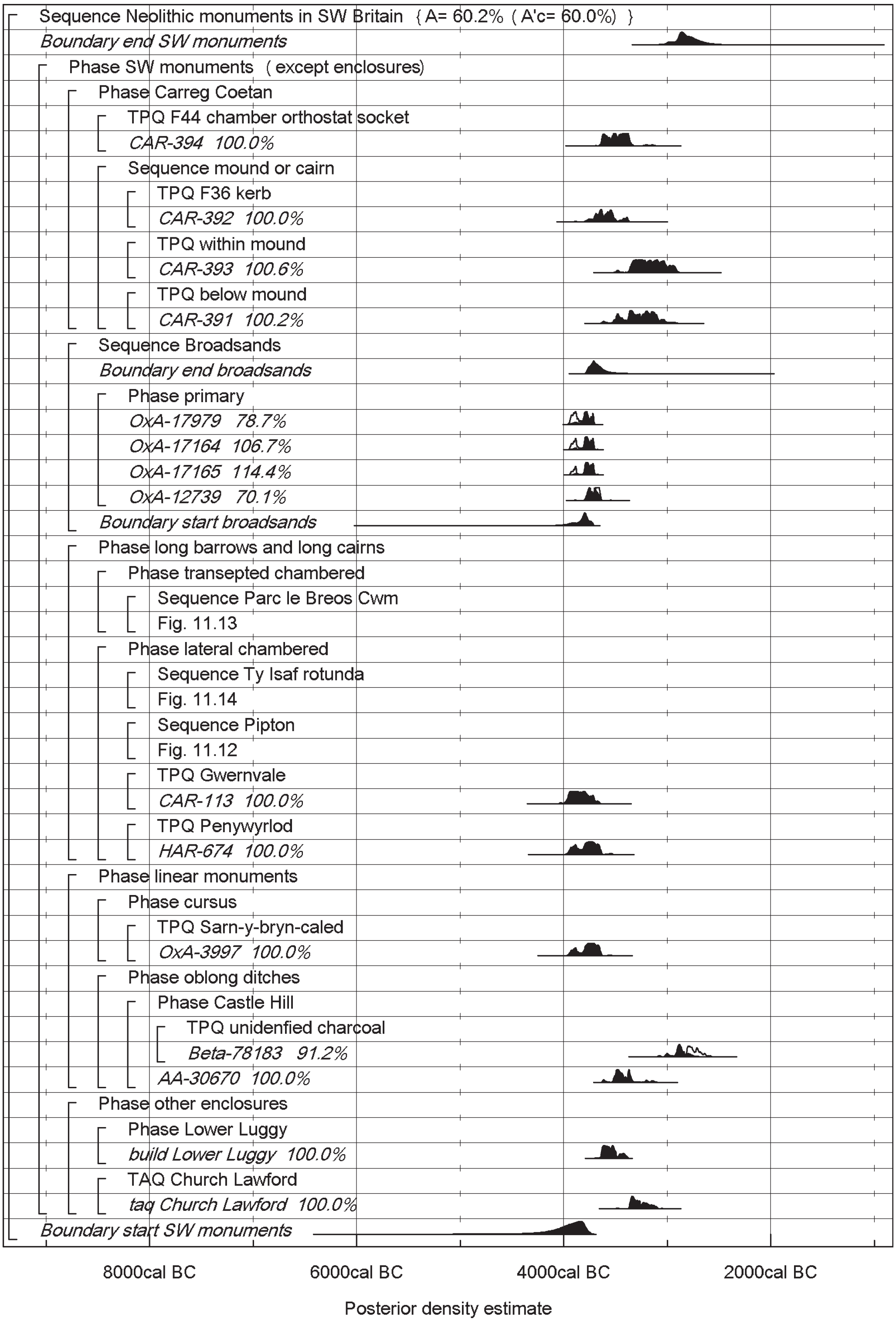


Fig. 14.67. Overall structure of the chronological model for the currency of early Neolithic monuments in south-west Britain. The component sections of this model are shown in detail in Figs 11.12–14 (Pipton, Parc le Breos Cwm, and Ty Isaf) (although the posterior density estimates shown on these figures are not those relating to this model). Distributions have been taken from the model defined in Fig. 11.15 (Church Lawford and Lower Luggy). The large square brackets down the left-hand side of the figures, along with the OxCal keywords, define the overall model exactly.

14.68: *start SE pots*), probably in *4055–3995 cal BC* (*68% probability*).

According to our models, the first Neolithic in south-central Britain appeared in *3975–3835 cal BC* (*95% probability*; Fig. 14.57: *start S central Neolithic*), probably in *3930–3855 cal BC* (*68% probability*). The first monumental construction appeared in this area in *3940–3765 cal BC* (*95% probability*; Fig. 14.63: *start S central monuments*),

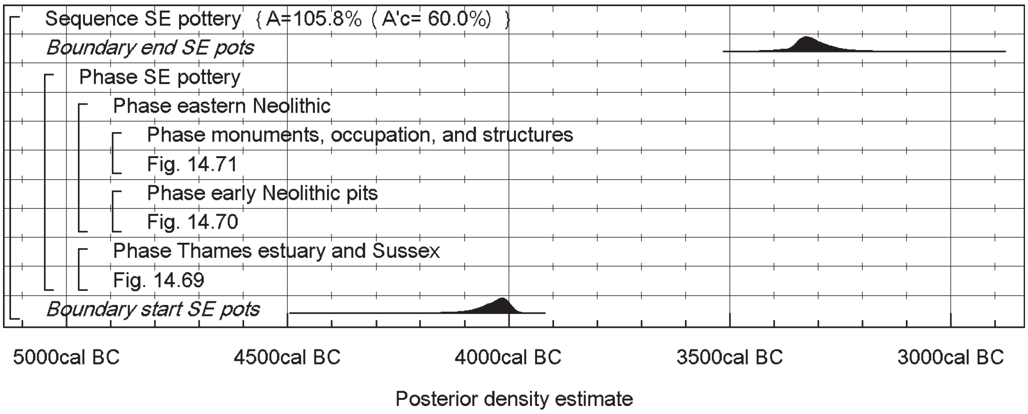


Fig. 14.68. Overall structure of the chronological model for the currency of Bowl pottery in south-east England. The component sections of this model are shown in detail in Figs 14.69–71. The large square brackets down the left-hand side of the figures, along with the OxCal keywords, define the overall model exactly.

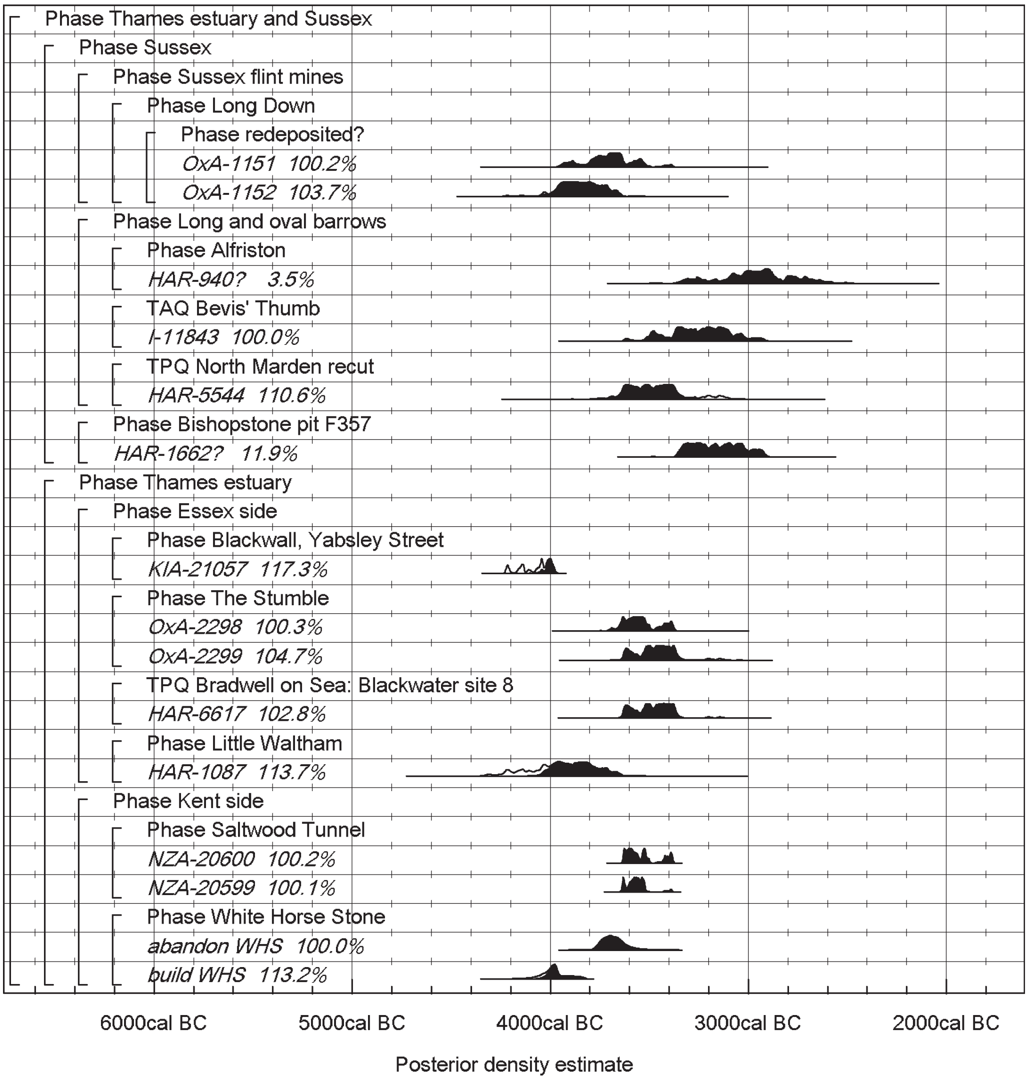


Fig. 14.69. Probability distributions of dates associated with Bowl pottery in the Thames estuary and Sussex. The distributions for White Horse Stone have been taken from the model defined in Fig. 7.26. The format is identical to that of Fig. 14.1. The overall structure of this model is shown in Fig. 14.68, and its other components in Figs 14.70–1.

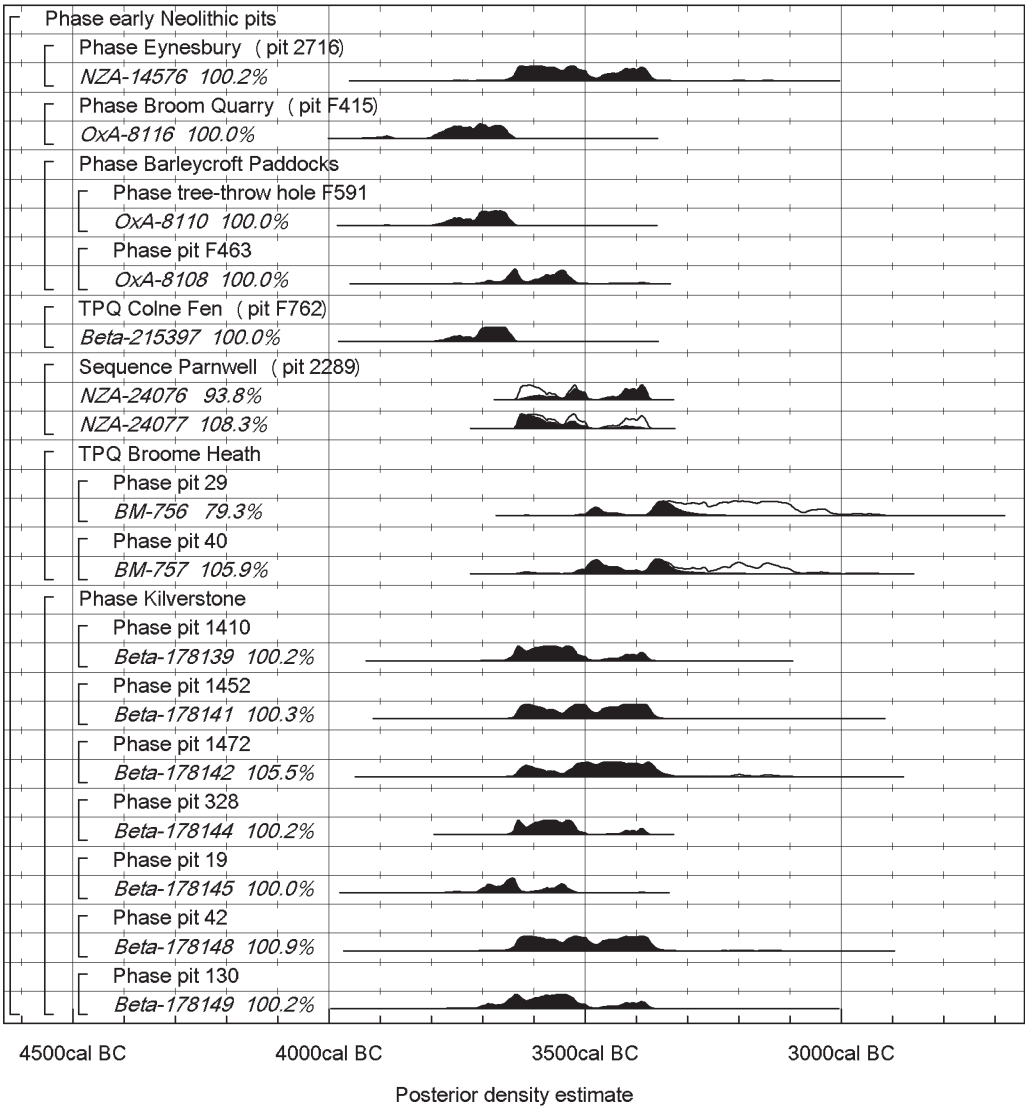


Fig. 14.70. Probability distributions of dates associated with Bowl pottery from pits in eastern England. The format is identical to that of Fig. 14.1. The overall structure of this model is shown in Fig. 14.68, and its other components in Figs 14.69 and 14.71.

probably in *3870–3790 cal BC* (*68% probability*). The first pottery appeared in south-central Britain in *3985–3830 cal BC* (*95% probability*; Fig. 14.72: *start S central pots*), probably in *3930–3850 cal BC* (*68% probability*).

The first Neolithic in south-west Britain, according to our models, appeared in *3855–3735 cal BC* (*95% probability*; Fig. 14.57: *start SW Neolithic*), probably in *3820–3760 cal BC* (*68% probability*). The first monumental construction appeared in this area in *4315–3735 cal BC* (*95% probability*; Fig. 14.67: *start SW monuments*), probably in *4030–3785 cal BC* (*68% probability*). The first pottery appeared in south-west Britain in *3820–3715 cal BC* (*95% probability*; Fig. 14.77: *start SW pots*), probably in *3785–3730 cal BC* (*68% probability*).

The number of years between the appearance of the first Neolithic things and practices and the appearance of the first pottery, area by area, is shown in Fig. 14.81. Pottery appeared in south-east England *−105–70 years* after the appearance of the first Neolithic (*95% probability*; Fig. 14.81: *start SE Neolithic/pots*), probably *−50–30 years* afterwards (*68% probability*). Pottery appeared in south-central England *−110–105 years* after the appearance of the first Neolithic (*95% probability*; Fig. 14.81: *start S central Neolithic/pots*), probably *−55–55 years* afterwards (*68% probability*). In south-west Britain, pottery appeared *−55–110 years* after the appearance of the first Neolithic (*95% probability*; Fig. 14.81: *start SW Neolithic/pots*), probably *−10–70 years* afterwards (*68% probability*).

These estimates for the gap between the appearance of pottery and the start of the Neolithic in an area can be negative, because in each case the precision of the estimates cannot determine that there is no possibility that the first pottery appeared before the first Neolithic (as our estimates for the start of the Neolithic include all the data associated with pottery in an area, this is obviously not possible!). This is because the models for the currency of Bowl pottery in

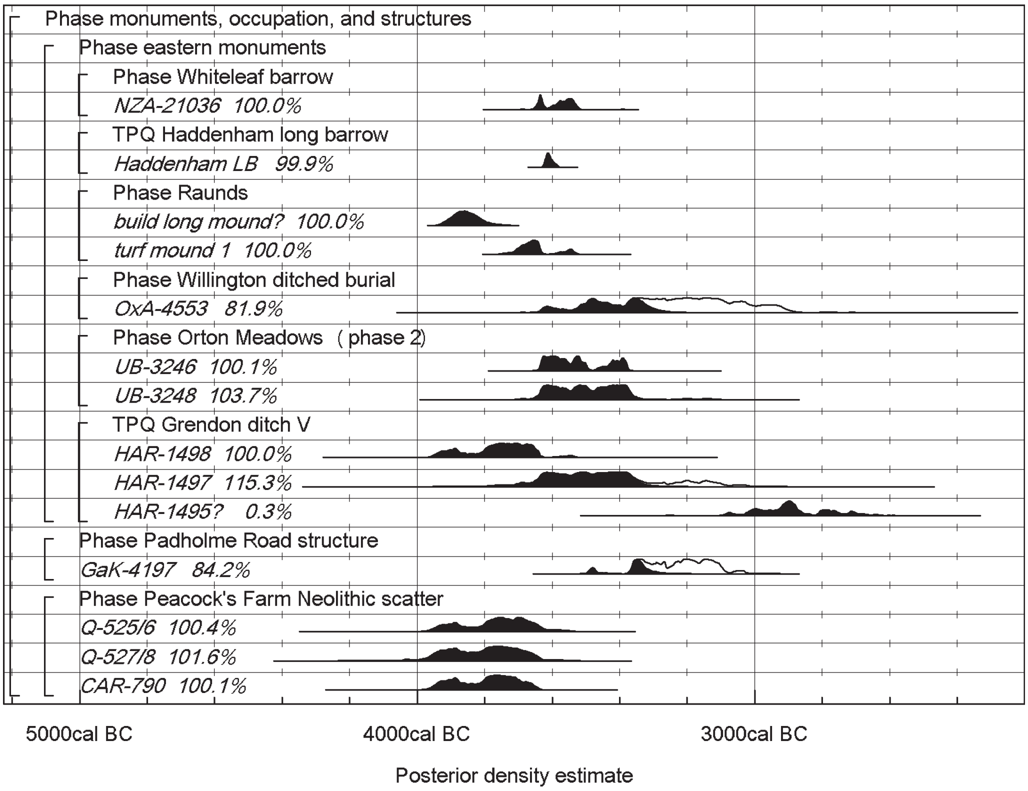


Fig. 14.71. Probability distributions of dates associated with Bowl pottery from monuments, occupation and structures in eastern England. The format is identical to that of Fig. 14.1. Distributions have been taken from models defined in Fig. 6.6 (Whiteleaf), Figs 6.16–17 (Haddenham long barrow), Figs 6.25–7 (Raunds), and Fig. 6.18 (Peacock's Farm). The overall structure of this model is shown in Fig. 14.68, and its other components in Figs 14.69–70.

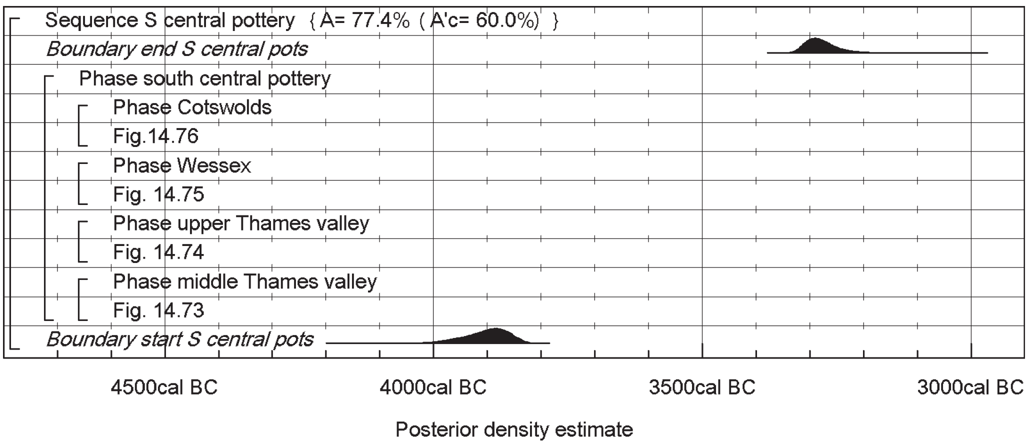


Fig. 14.72. Overall structure of the chronological model for the currency of Bowl pottery in south-central England. The component sections of this model are shown in detail in Figs 14.73–6. The large square brackets down the left-hand side of the figures, along with the OxCal keywords, define the overall model exactly.

each area rely on fewer data, and so the resultant posterior density estimates are less precise. Archaeologically, these distributions mean that pottery appeared in each area at a date very close to the first Neolithic – certainly within one or two generations, and very probably as a primary element of these innovations. There is a slightly greater possibility that pottery may have appeared in south-west Britain a generation or two after other elements, as this distribution has a larger probability of a real gap (Fig. 14.81). Given the available sample of dates, too much reliance should not be placed on this tentative trend. On this basis, therefore, we feel that any aceramic phase at the start of the southern British Neolithic is implausible.

The numbers of years between the appearance of the first Neolithic things and practices and the appearance of the first monument other than an enclosure, area by area,

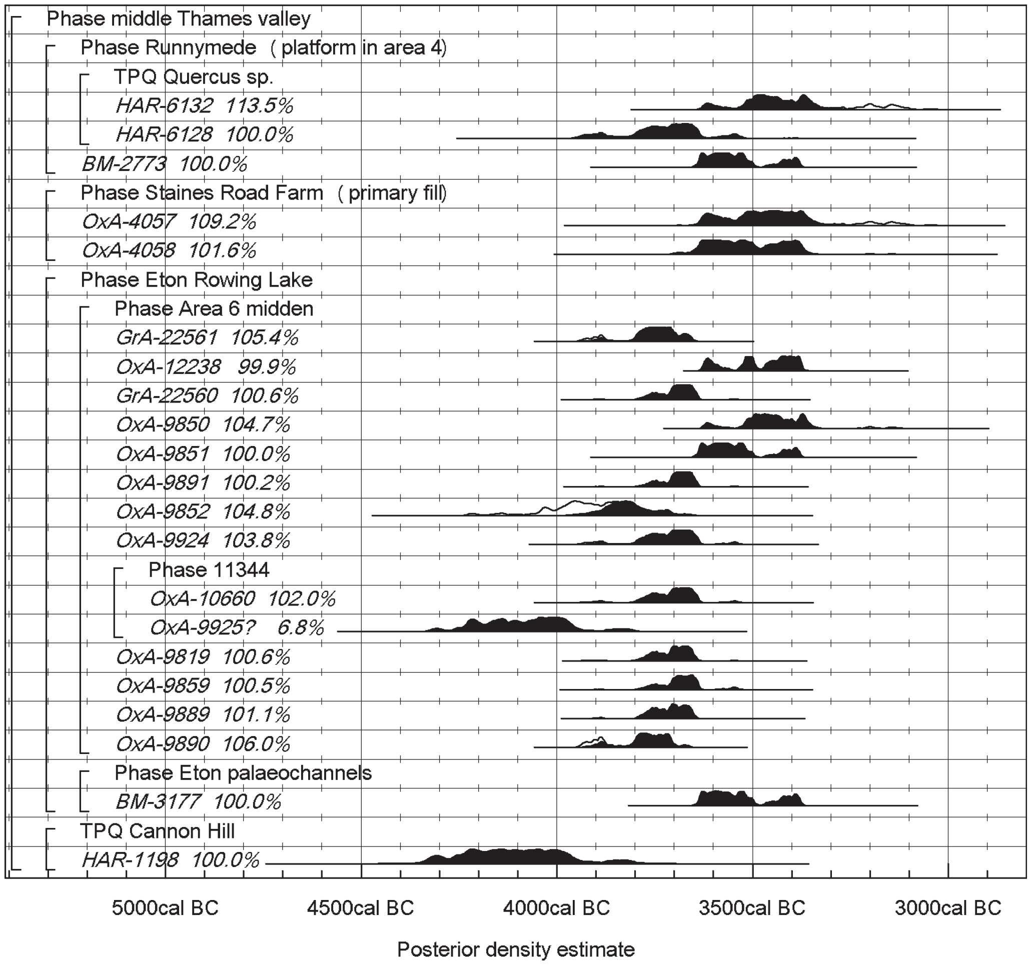


Fig. 14.73. Probability distributions of dates associated with Bowl pottery in the middle Thames valley. The format is identical to that of Fig. 14.1. The overall structure of this model is shown in Fig. 14.72, and its other components in Figs 14.74–6.

are shown in Fig. 14.82. The first monument appeared in south-east England −*155–215 years* after the appearance of the first Neolithic (*95% probability*; Fig. 14.82: *start SE Neolithic/monuments*), probably −*15–145 years* afterwards (*68% probability*). The first monument appeared in south-central England −*60–170 years* after the appearance of the first Neolithic (*95% probability*; Fig. 14.82: *start S central Neolithic/monuments*), probably *10–115 years* afterwards (*68% probability*). In south-west Britain, the first monument appeared −*535–75 years* after the appearance of the first Neolithic (*95% probability*; Fig. 14.82: *start SW Neolithic/monuments*), probably −*245–15 years* afterwards (*68% probability*).

In south-east and south-central England, it appears that monuments may not have formed a primary element of the first Neolithic activity, appearing several generations after that had begun (Fig. 14.82). The start of monumentality in south-west Britain must be later than the first appearance of the Neolithic there, since all the likelihoods relating to monuments are included in the more general model. The estimate for the start of monumentality in this area must therefore be anomalous. This seems to be because we have too few dates from too many monuments in this area to counteract the statistical scatter on our estimates for the use of each monument. In reality, the first monument in the south-west must have been contemporary with or only very slightly later than the first appearance of other Neolithic activity.

These estimates relate to monuments other than causewayed and stone-walled enclosures. The gaps between the earliest Neolithic and the first enclosure in our larger areas are shown in Fig. 14.83. Enclosures do not form an element of the first Neolithic in any of these areas, appearing two or three centuries after the start in south-east and south-central England, and perhaps a century or so later in south-west Britain. It should be noted that the interval shown in Fig. 14.83 for south-west Britain compares the start of Neolithic activity on the south-west peninsula and in south Wales and the Marches with the date of the first enclosure in the south-west peninsula (which is earlier than the first enclosure in south Wales and the Marches).

In more detail, the gaps between the earliest Neolithic and the first enclosure in each of our smaller regions are shown in Fig. 14.84. Here, we have compared the first enclosure in the middle and upper Thames with our estimated dates for the start of the Neolithic in both the

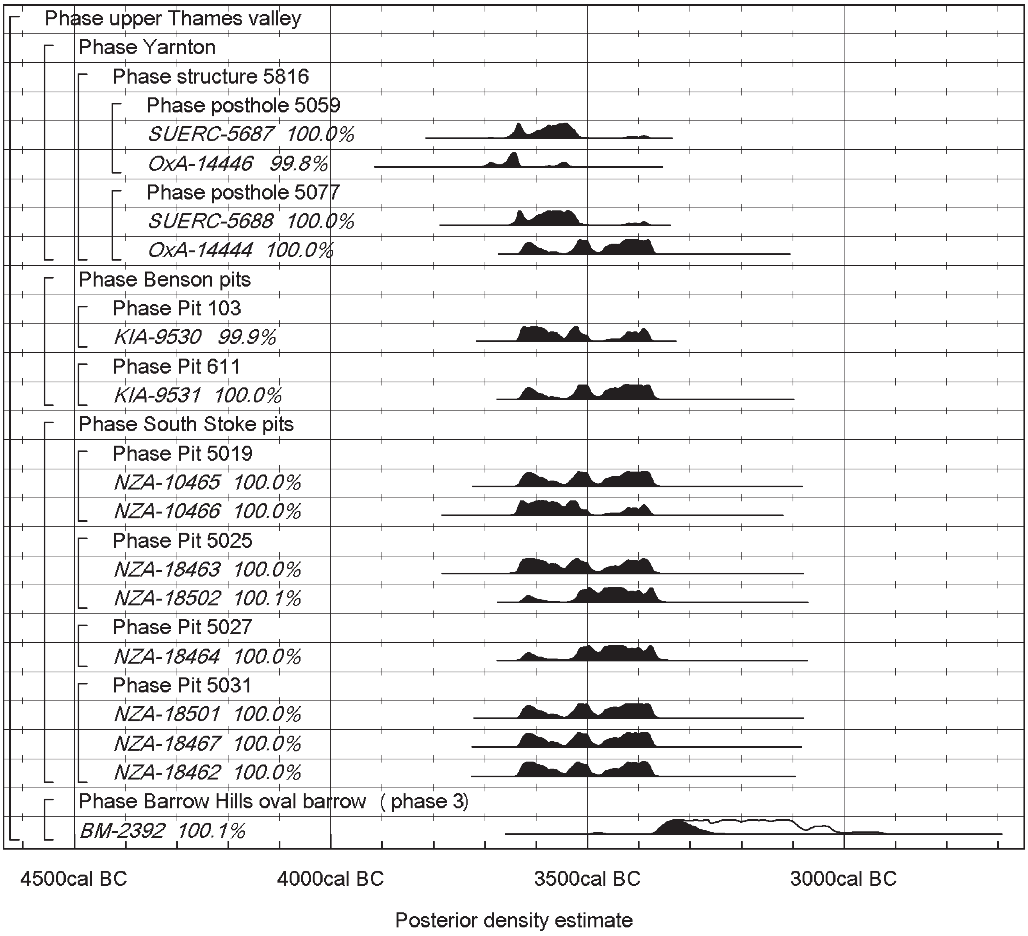


Fig. 14.74. Probability distributions of dates associated with Bowl pottery in the upper Thames valley. The format is identical to that of Fig. 14.1. The overall structure of this model is shown in Fig. 14.72, and its other components in Figs 14.73 and 14.75–6.

middle and upper Thames, and we have compared the date of the start of the Neolithic in north Wessex with the first enclosure in north Wiltshire. The estimates for the start of the Neolithic in south Wessex and the first enclosure in south Wessex are not strictly comparable as data from Salisbury plain are excluded from the former and included in the latter. Despite these slightly different definitions of the regions, the patterns shown are broadly valid. As enclosures come all at a rush, in regions where the Neolithic began comparatively early there was a gap of several centuries between the first Neolithic and the first enclosure. In other regions, where Neolithic activity appeared rather later, building enclosures may have begun perhaps three or four generations after the start of the Neolithic.

So, if neither monuments nor enclosures are elements of the first Neolithic in south-east and south-central England, do enclosures anywhere form primary elements of monumentality? The answer is no. Figure 14.85 shows the numbers of years between the first monument in each of our areas and the first enclosure (here again we have used the estimate for the start of enclosures in the south-west peninsula for this analysis because there are too few dated sites in south Wales and the Marches to provide an overall estimate for the wide south-west British area). In each of the areas considered, enclosures appeared at least two generations after the first monument. In the south-east, this interval was rather longer, probably more than a century. Nowhere, however, was the gap so long that memory of the first monument need have been lost by the time the first enclosure was built.

Is something of the tempo of change in Neolithic lives beginning to emerge out of these analyses? Compare the gap between the start of the Neolithic and the start of monumentality in an area (Fig. 14.82) with the gap between the start of monumentality and the first enclosure in the same area (Fig. 14.85). Could we see, from these estimates, major innovations as following a cycle measurable in lifetimes? We can also remember here the rhythm in the construction of enclosures themselves (Fig. 14.20), with a lull in the early 36th century cal BC, and perhaps a move to the construction of cursus monuments later in that century (Fig. 14.44), which might also conform to approximately the same temporal rhythm. If so, could this point towards important principles of seniority in the Neolithic worldview, or more generally towards the spans of active memory? So when the elders of the community, say, who had initiated

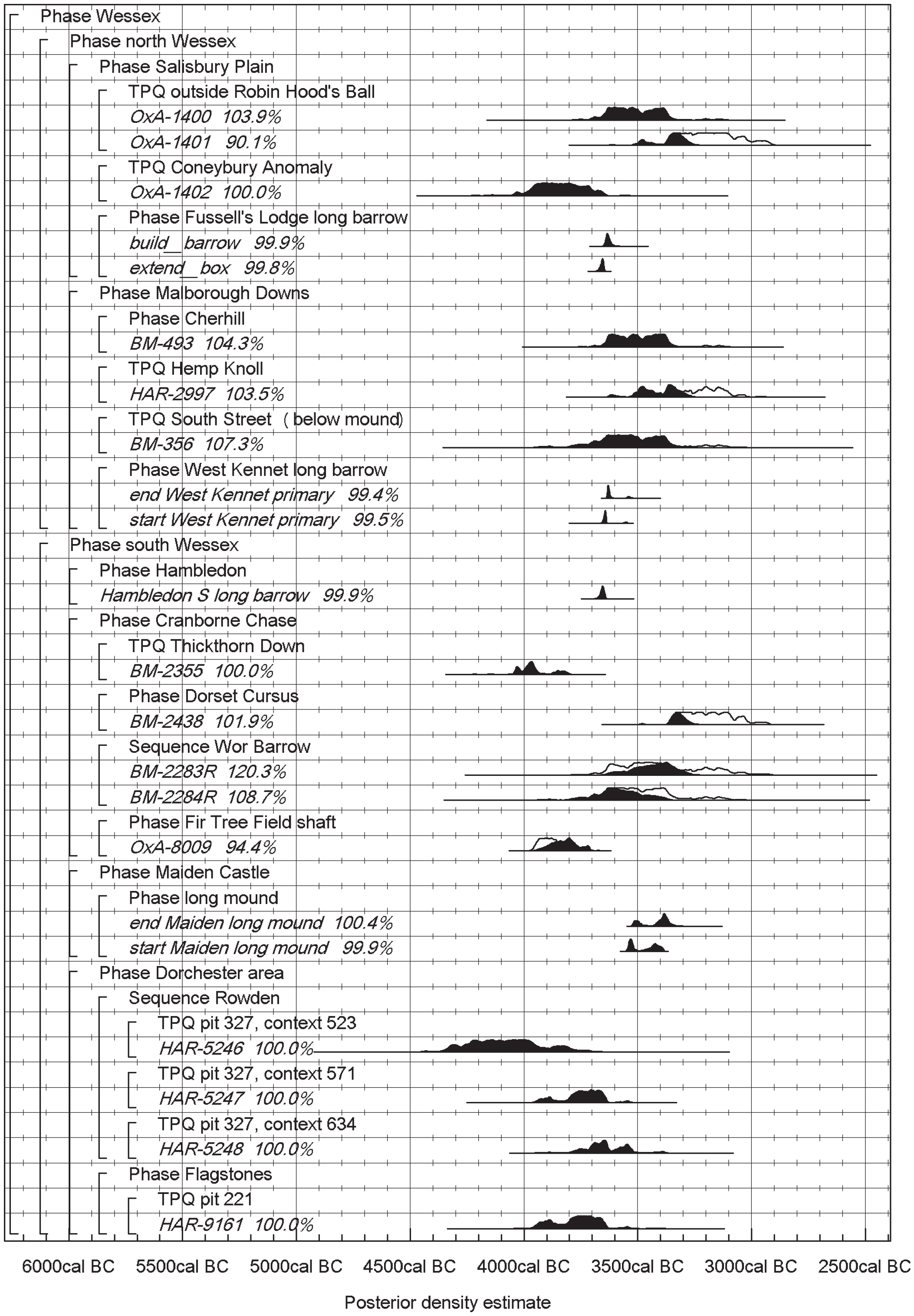


Fig. 14.75. Probability distributions of dates associated with Bowl pottery in Wessex. The format is identical to that of Fig. 14.1. Distributions have been taken from the models defined by Figs 4.7–13 (Hambledon Hill), Fig. 4.21 (Fir Tree Field shaft), Figs 4.41–5 (Maiden Castle), Wysocki et al. *(2007, fig. 10) (Fussell's Lodge), and Bayliss* et al. *(2007b, fig. 6) (West Kennet). The overall structure of this model is shown in Fig. 14.72, and its other components in Figs 14.73–4 and 14.76.*

new practices in their youth, came to the end of their days, did the memory of their achievements pass as their direct power over fresh events faded?

Finally, we consider the date when the early Neolithic ended in southern Britain. Our regional estimates for this transition vary substantially, spanning the latter half of the fourth millennium cal BC (compare, for example, *end Sussex Neolithic* (Fig. 5.32) with *end north Wessex* (Fig. 14.52)). This variability seems to be related to the composition of the dataset in each region, and hints that

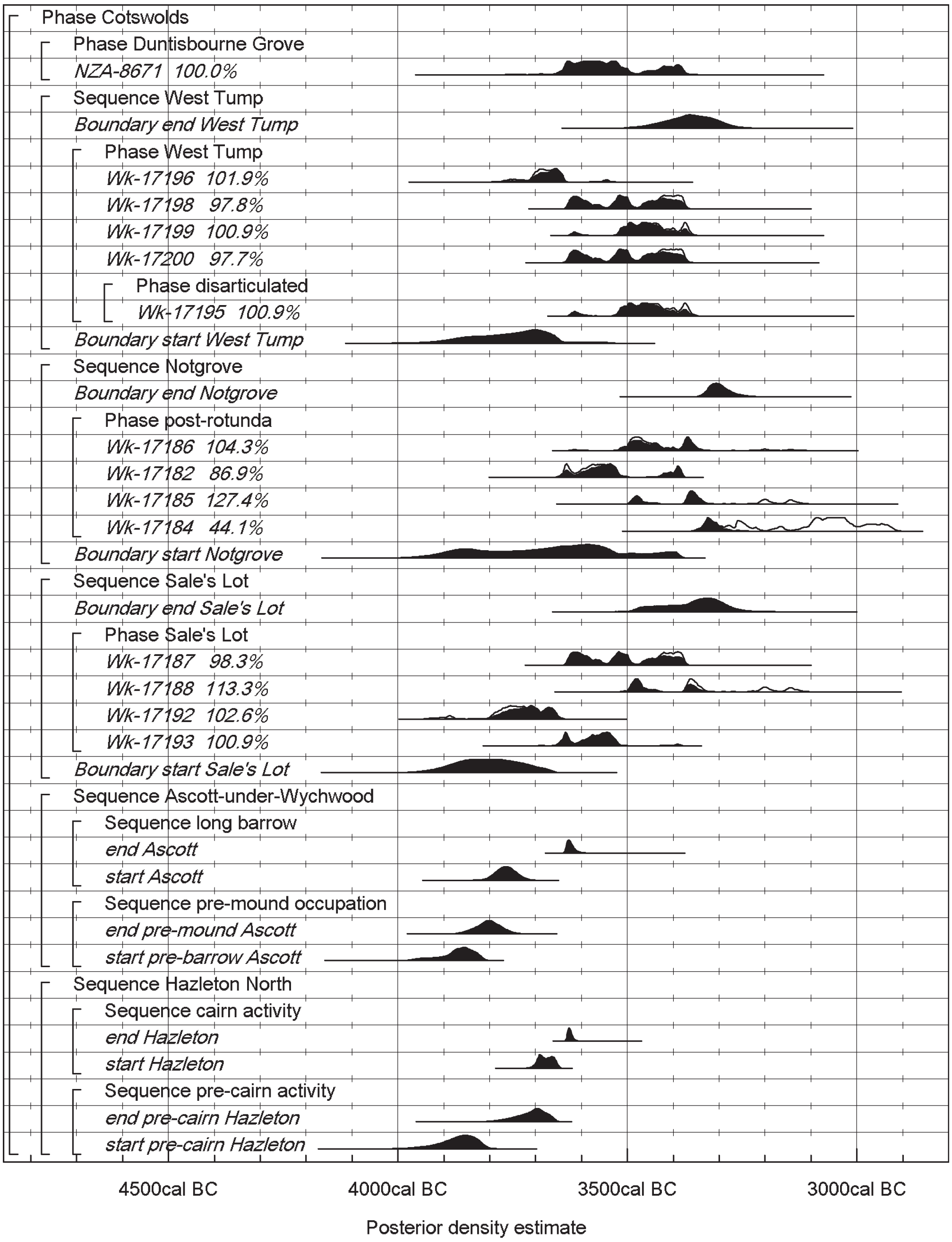


Fig. 14.76. Probability distributions of dates associated with Bowl pottery in the Cotswolds. The format is identical to that of Fig. 14.1. Distributions have been taken from the models defined by Meadows et al. *(2007, figs 6–9) (Hazleton) and Bayliss* et al. *(2007c, figs 3 and 5–7) (Ascott-under-Wychwood). The overall structure of this model is shown in Fig. 14.72, and its other components in Figs 14.73–5.*

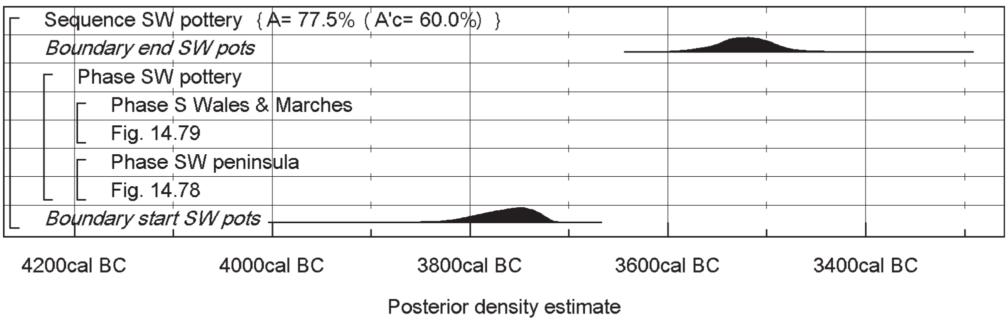


Fig. 14.77. Overall structure of the chronological model for the currency of Bowl pottery in south-west Britain. The component sections of this model are shown in detail in Figs 14.78–9. The large square brackets down the left-hand side of the figures, along with the OxCal keywords, define the overall model exactly.

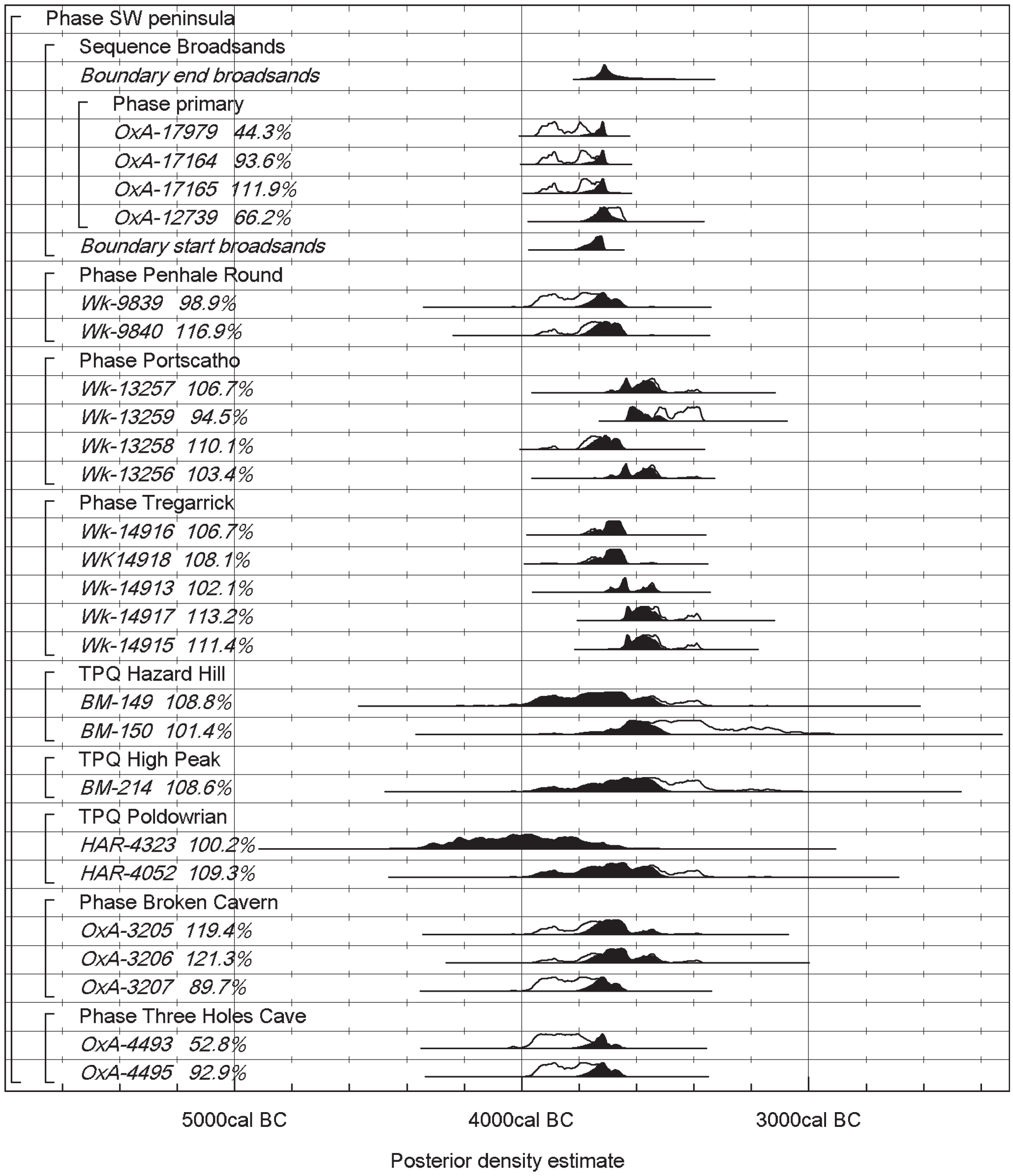


Fig. 14.78. Probability distributions of dates associated with Bowl pottery in the south-west peninsula. The format is identical to that of Fig. 14.1. The overall structure of this model is shown in Fig. 14.77, and its other component in Fig. 14.79.

different early Neolithic things and practices may have fallen out of favour at different times. This is apparent from Fig. 14.86, which shows the date when the early Neolithic ended in each of our larger areas, and the independent estimates for when the currency of Bowl pottery ended and when the monument types included in this study went out of primary use. It is clear that our date estimates for the 'end of the early Neolithic' are composite creations.

The end of the deposition of Bowl pottery in south-east and south-central England probably falls in the later part of the 34th or earlier part of the 33rd century cal BC (Fig. 14.86). The end of this tradition in south-west Britain, however, may be significantly earlier – ending in *3585–3465 cal BC* (*95% probability*; Fig. 14.77: *end SW pots*), probably in *3550–3490 cal BC* (*68% probability*). Table 14.6 shows that we have not dated fewer samples associated with Bowl pottery in south-west Britain than in the other areas, and so it is difficult to explain this difference as sampling bias. This unexpectedly early date for a change in ceramic fashion there may be an aspect of the distinct character of the Neolithic archaeology of the south-west peninsula (Chapter 10) and of parts of south Wales (e.g. Lynch 2000). In the south-west peninsula pottery use may even have diminished, given the scarcity there of Peterborough Ware and subsequently of Grooved Ware (Laidlaw and Mepham 1999, 44–5; Longworth and Cleal 1999).

The ends of the use of the monument types considered in this study in different areas of southern Britain are shown in Fig. 14.86. These agree in placing the end of the currency of these monument types in the first century or two of the third millennium cal BC. Again, not all kinds of monument may have ended at the same time. Linear monuments (Fig. 14.44), monuments that we have grouped as diverse and

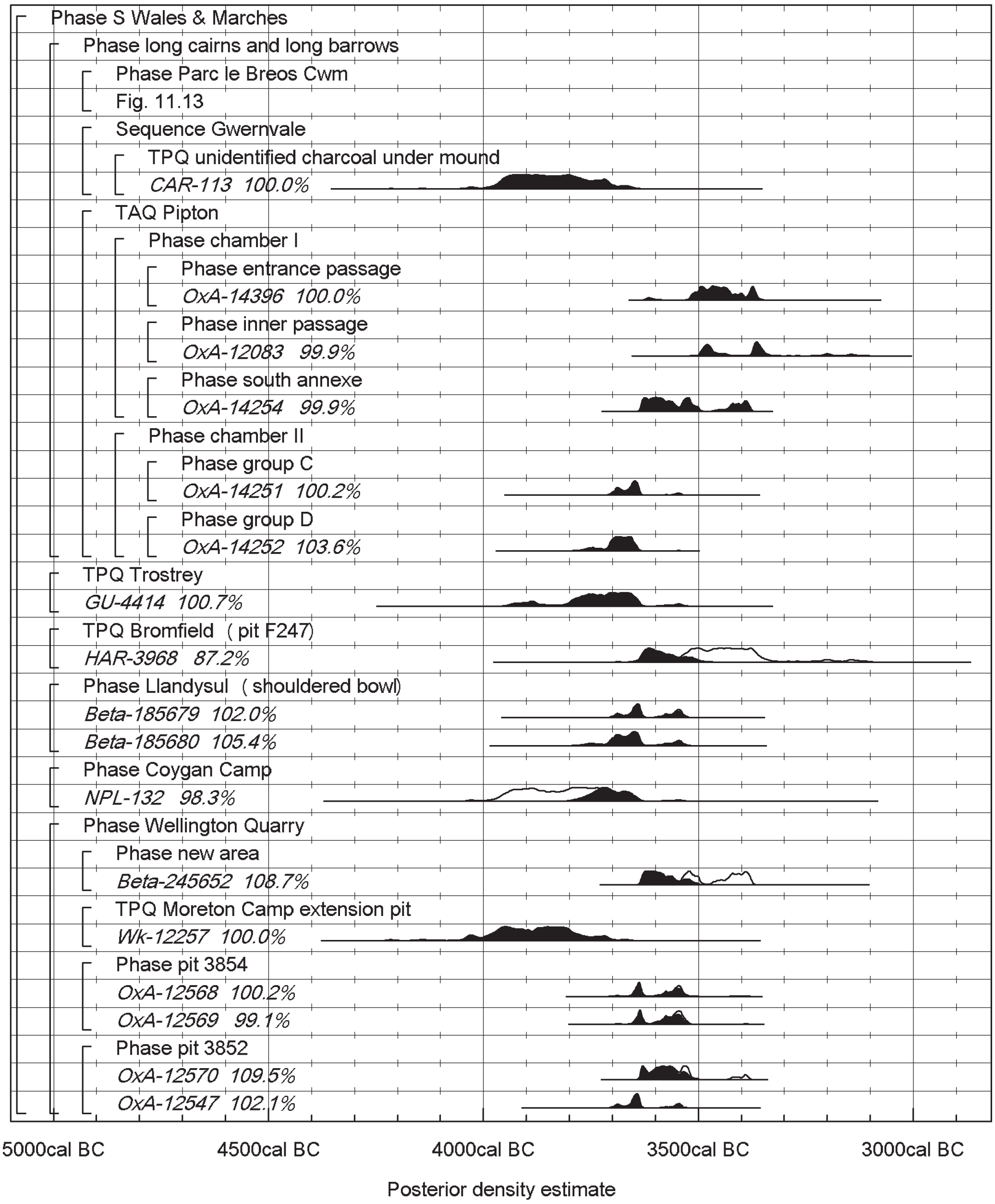


Fig. 14.79. Probability distributions of dates associated with Bowl pottery in south Wales and the Marches. The format is identical to that of Fig. 14.1. The component relating to Parc le Breos Cwm long cairn is shown in Fig. 11.13 (although the posterior density estimates shown on this figure are not those relating to this model). The overall structure of this model is shown in Fig. 14.77, and its other component in Fig. 14.78.

small (Fig. 14.43) and oval barrows (Fig. 14.42) seem to continue to be used into the third millennium. Long barrows and long cairns may have fallen out of favour a century or two earlier (Fig. 14.45). Causewayed and stone-walled enclosures themselves went out of primary use earlier still (Fig. 14.1). The only portal dolmen in southern Britain dated at the time of modelling, Carreg Coetan, may have been constructed around that time (Fig. 11.10).[7]

14.5 Patterns and development of early Neolithic material culture in southern Britain

The often large stratified artefact assemblages from causewayed enclosures have long provided a basis for the periodisation and classification of Neolithic material culture, for example by Piggott (1954). They have also made a major contribution to the interpretation of the uses of the enclosures, both as foci of consumption and exchange and as gathering places for perhaps widely scattered populations. The recognition in the inter-war period of pottery and axeheads of non-local origin at sites such as Hembury, Windmill Hill and Maiden Castle was a stimulus to their sourcing. Since then, all classes of artefact from enclosures have been the subject of study and analysis. This section concerns itself primarily with pottery and axeheads because they are less unevenly documented

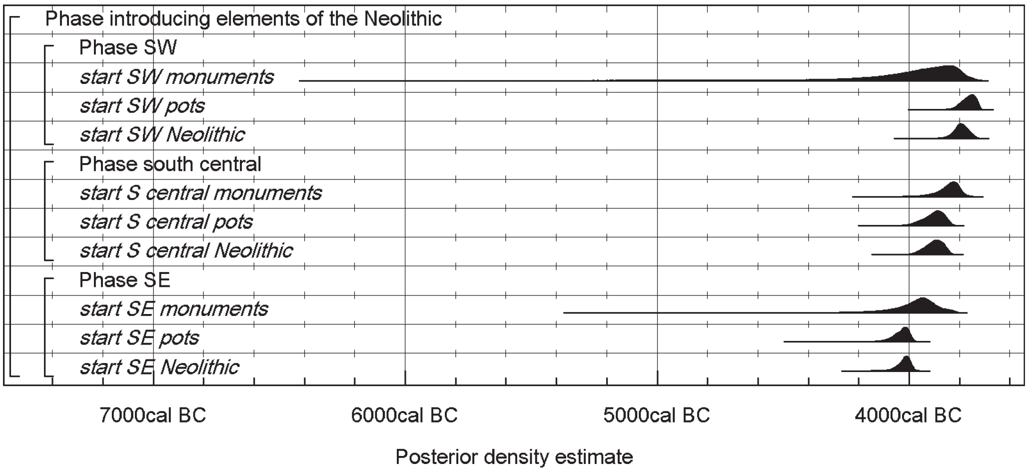


Fig. 14.80. Probability distributions of dates for the start of the early Neolithic, the appearance of pottery and the appearance of monuments in different areas of southern Britain, derived from the models shown in Fig. 14.57, 14.60–7 and 14.68–79.

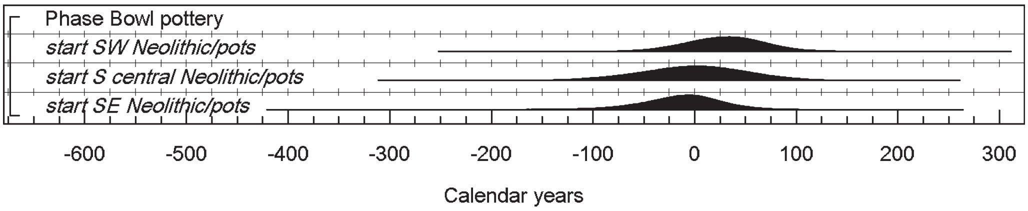


Fig. 14.81. Probability distributions showing the number of years between the appearance of the first Neolithic activity and the first pottery in an area of southern Britain (derived from the distributions shown in Fig. 14.80).

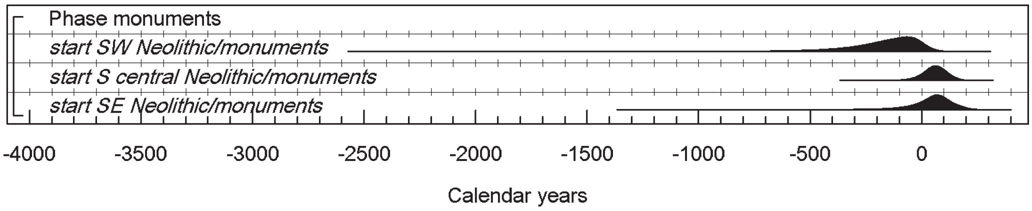


Fig. 14.82. Probability distributions showing the number of years between the appearance of the first Neolithic activity and the first monument in three areas of southern Britain (derived from the distributions shown in Fig. 14.80).

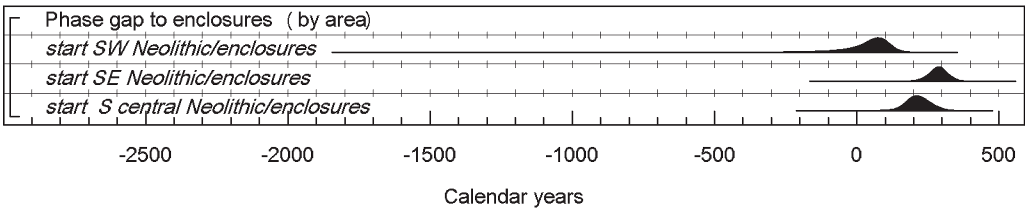


Fig. 14.83. Probability distributions showing the number of years between the appearance of the first Neolithic activity and the first causewayed or stone-walled enclosure in three areas of southern Britain (derived from the distributions shown in Figs 14.18 and 14.57).

across the gamut of enclosures and contexts beyond them than other artefact classes.

Bowl pottery

The date of the introduction of pottery into each broad area of our analysis of southern Britain is summarised in Fig. 14.80. Having earlier examined different components of the range of Neolithic things and practices, we can now investigate the chronology of different ceramic traditions. In the case of Carinated Bowl and other plain Bowl, the available numbers of dated contexts are so few that their chronologies are modelled across the whole of southern Britain (Figs 14.88, 14.90). This is unsatisfactory not only because of the small number of dates, many of which are *termini post quos*, but because pottery seems

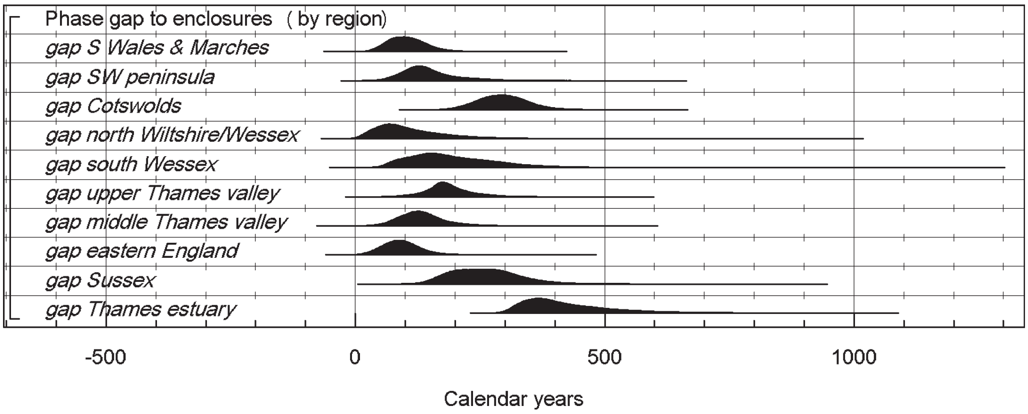


Fig. 14.84. Probability distributions showing the number of years between the appearance of the first Neolithic activity and the first causewayed or stone-walled enclosure in various regions of southern Britain (derived from the distributions shown in Figs 14.15 and 14.54).

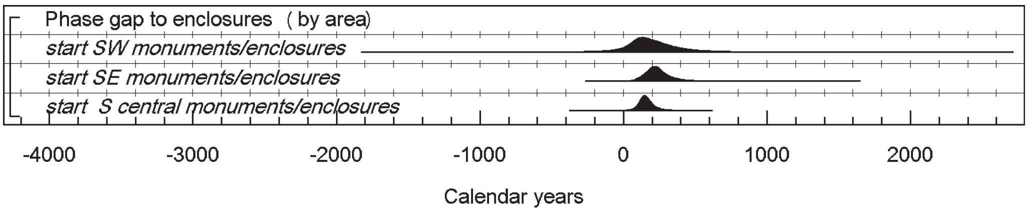


Fig. 14.85. Probability distributions showing the number of years between the appearance of the first monument and the first causewayed or stone-walled enclosure in various areas of southern Britain (derived from the distributions shown in Figs 14.18 and 14.80).

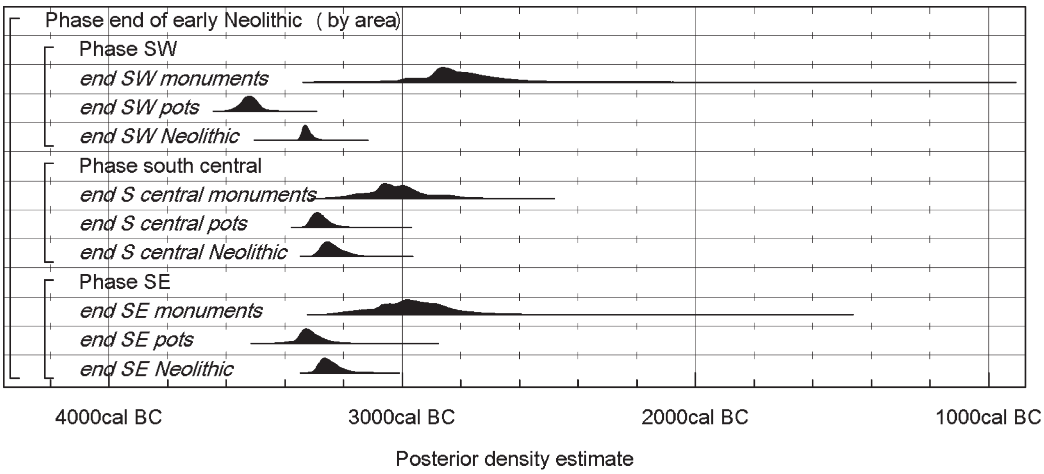


Fig. 14.86. Probability distributions of dates for the end of the early Neolithic, the end of the currency of Bowl pottery, and the final primary use of early Neolithic monuments in different areas of southern Britain, derived from the models shown in Fig. 14.57, Figs 14.60–7, and Figs 14.68–79.

to have come into use at different times in different areas of southern Britain (Fig. 14.80). Fewer sites are included in these analyses than in those for the overall currency of Bowl pottery in the same areas (Fig. 14.80) because some assemblages are so small and fragmentary as to defy finer classification and others are not yet fully analysed or published, so that their character sometimes remains uncertain.

Carinated Bowl. This term is employed to denote assemblages characterised by, although not always consisting completely of, open or neutral Bowls with a change in angle low on the body wall and with light simple or rolled-over rims and a fine finish (Fig. 14.87; Cleal 2004, 177–80). 'Carinated' is not used to encompass all shouldered vessels, as it is by some authors. The tradition is less frequent in the south of Britain than in the north of England, Scotland or Ireland. It occurs thinly through most of the study area, with the possible exception of Cornwall. Its contexts in southern Britain are often non- or pre-monumental (Table 14.7) – a very different situation

Table 14.7. Carinated Bowl pottery associated with the dates shown in Fig. 14.88.

Site	**Subdivision**	**Illustrations or descriptions**	**Distribution**	**Notes**
Little Waltham	Pit 251	Drury 1978, fig. 36	*HAR-1087*	
Yabsley Street		S. Coles *et al.* 2008, fig. 4	*KIA-20157*	
Orton Meadows	1st alignment	Mackreth forthcoming	UB-3248	Date for articulated burial in 2nd alignment provides *terminus ante quem* for pot in 1st alignment
Peacock's Farm	Scatter of Neolithic occupation material in peat	J. Clark *et al.* 1935, figs 12–13	*Q-525/6*, *Q-527/8*, *CAR-790*	
Barleycroft Paddocks	F591	C. Evans *et al.* 1999 (verbal description only)	*OxA-8110*	
Cannon Hill	Pit 1, layer 4. In single black layer with charcoal, struck flint (inc. leaf arrowhead and microlith), bone fragments, in a feature which was probably a solution pipe	Bradley *et al.* 1981, fig. 5: 1–9	*HAR-1198*	
South Street		Ashbee *et al.* 1979, fig 30: 1, 2	*BM-356*	
Rowden	Pit 327	P. Woodward 1991, fig. 52	*HAR-5248*	
Ascott-under-Wychwood	Pre-barrow midden	Barclay and Case 2007, figs 10.1–3	Between *start Ascott pre-barrow* and *end Ascott pre-barrow*	
Hazleton	Pre-cairn occupation	Smith and Darvill 1990, fig. 156	Between *start pre-cairn Hazleton* and *end pre-cairn Hazelton*	
Sweet Track		I. Smith 1976; Kinnes 1979b; Coles and Orme 1984a; Coles and Coles 1986, fig. 15	*Sweet Track*	
Broadsands		Radford 1958; Sheridan *et al.* 2008	Between *start broadsands* and *end broadsands*	
Gwernvale	F68	Britnell and Savory 1984, figs 38, 39, 43	*CAR-113*	

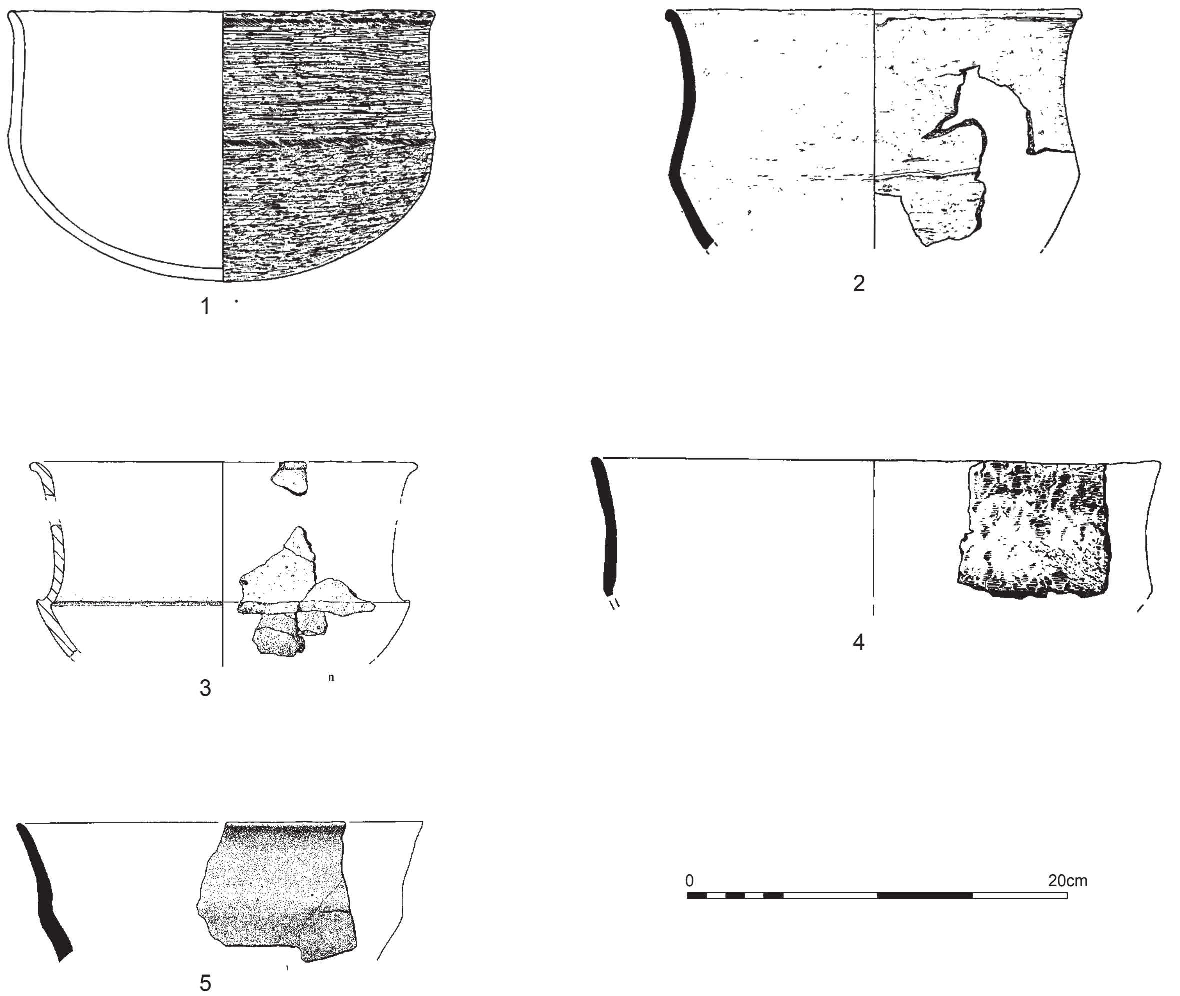


Fig. 14.87. Carinated Bowl pottery. 1 found in two heaps 1 m apart beside the Sweet Track, site R, after J. Coles et al. *(1973, 288–9); 2 from pit 327 at Rowden, after Woodward (1991, fig. 52); 3 from the pre-cairn occupation at Ascott-under-Wychwood, after Barclay and Case (2007, fig. 10.1); 4 found behind the head of a possibly female skeleton buried in a grave at Yabsley Street, Blackwall, after S. Coles* et al. *(2008, fig. 4); 5 from Lane Fox's (later Pitt Rivers') excavations in the Cissbury flint mines, after Barber* et al. *(1999, fig. 5.13).*

from farther north and west. The only indication of relation to an enclosure is in a brief description of the unpublished Chalk Hill pottery '. . . the assemblage contained a mixture of early Carinated Bowls (represented by fragmentary or residual material) with much larger quantities of Plain and shouldered Bowls', with relatively little decoration (Gibson and Leivers 2008, 252).

A model for the currency of Carinated Bowl in southern Britain is shown in Fig. 14.88. This estimates that the tradition first appeared in southern Britain in *4185–3975 cal BC* (*95% probability*; Fig. 14.88: *start CB S Britain*), probably in *4080–3990 cal BC* (*68% probability*). The tradition ended in southern Britain in *3715–3505 cal BC* (*95% probability*; Fig. 14.88: *end CB S Britain*), probably in *3685–3595 cal BC* (*68% probability*). The early date estimate for the introduction of this pottery type is entirely due to the date from Yabsley Street, Blackwall (Fig. 14.88: *KIA-20157*); no other dated assemblage from southern Britain need be earlier than 3800 cal BC.

Plain Bowl. Undecorated assemblages include some which do not correspond to even a broad definition of Carinated Bowl, their features including closed forms as well as open or neutral ones, bag-like, rounded or heavily shouldered profiles, some heavier rims, and coarser, thicker fabrics than those of much Carinated Bowl (Fig. 14.89). The assemblages and single vessels listed in Table 14.8 exclude indeterminate fragments. They fall into two main groups. Some could have been drawn from the undecorated component of Decorated assemblages, for example the single vessels placed in tomb chambers at Ascott-under-Wychwood (Barclay and Case 2007, fig. 10.4) and Hazleton (Smith and Darvill 1990, fig. 157: 33), or the relatively few sherds from the Etton Woodgate enclosure (Gdaniec 2005). Others are coherent assemblages of distinct, but not uniform, character. An obvious example is provided by over 400 vessels from Broome Heath, Norfolk, which lack decoration apart from rare fluting or rilling and are morphologically distinct from both local Decorated

Table 14.8. Plain Bowl pottery associated with the dates shown in Fig. 14.90.

Site	Sub-division	Illustrations or descriptions	Distribution
South-east			
Etton Woodgate	In ditches	Gdaniec 2005	Between *start Woodgate* and *end Woodgate*
Eynesbury	Pit 2716	Mepham 2004, fig. 17	*NZA-14576*
Gorhambury	In bedding trenches of structure	Neal *et al.* 1990, fig. 152: 1–4	*HAR-3484*
Padholme Road, Fengate	In bedding trenches of structure	Pryor 1974, fig. 6	*GaK-4197*
Broome Heath	Mainly in pits	Wainwright 1972, figs 25–34	*BM-756*, *BM-757*
South-centre			
Staines Road Farm	In first phase of ring ditch, and in second phase probably derived from first phase	P. Jones 2008	*OxA-4057*, *OxA-4058*
Gatehampton Farm, Goring	Ditch	T. Allen 1995, fig. 58: PRNs 4, 5, 6, 7, 8/104	Between *GrA-31358* and *BM-2835*
Ascott-under-Wychwood	Southern passage area	Barclay and Case 2007, fig. 10.4	Between *primary construction Ascott* and *end Ascott*
Cherhill		Evans and Smith 1983, fig. 23	*BM-493*
Coneybury Anomaly	In pit	J. Richards 1990, figs 28–31	*OxA-1402*
Fir Tree Field shaft	Hearth	French *et al.* 2007, fig. A4.7:P35	*OxA-8009*
Wor Barrow	Ditch	Cleal 1991, fig. 7.15: P175	*BM-2283R*, *BM-2284R*
Burn Ground	Near edge of blocking of S entrance to transverse chamber	Grimes 1960, fig. 30: upper	Before *end Burn Ground*
Hazleton	Lower fills of S chamber and passage	Smith and Darvill 1990, fig. 157:33	Between *construction finished* and *end Hazleton*
South-west			
Coygan Camp	In pit	Wainwright 1967	*NPL-132*
Parc le Breos Cwm	Multiple contexts, some sherds from pre-cairn surface	Whittle and Wysocki 1998, fig. 28: 5–7, possibly all one pot	Before *start Parc le Breos Cwm*

Table 14.9. Decorated Bowl pottery associated with the dates shown in Figs 14.92–9.

Site	Sub-division	South-Western element in assemblage	Illustrations or descriptions	Distribution
South-east				
Chalk Hill				Between *start Chalk Hill* and *end Chalk Hill*
Kingsborough 1			M. Allen *et al.* 2008, figs 7–8	Between *start Kingsborough 1* and *end Kingsborough 1*
Kingsborough 2			M. Allen *et al.* 2008, fig. 9	Between *start Kingsborough 2* and *end Kingsborough 2*
Orsett			Hedges and Buckley 1978, figs 32–35	Between *start Orsett* and *end Orsett*
Saltwood Tunnel				*NZA-20599, -20600*
St Osyth			Germany 2007, figs 44–48	Between *start St Osyth* and *end St Osyth*
The Stumble			N. Brown 1998, figs 78, 79	*OxA-2298, -2299*
Bury Hill	Both decorated sherds (drawings 4 and 5) described as from lower silts (Bedwin 1981, 82)		Bedwin 1981, fig. 7: 1–10	Between *build Bury Hill* and *end Bury Hill*
Offham Hill			Drewett 1977, fig. 11: 1, 2, 3, 5–12, 14, 19, 20	*burial 1*
Whitehawk			Ross Williamson 1930, pls V–VII; Curwen 1934a, figs 5–13, 23–40; Curwen 1936, figs 1–19	Between *build Whitehawk* and *end Whitehawk*
The Trundle			Curwen 1929b, pls VII–X; 1931, figs 10–14	*OxA-14009*, *OxA-14024*
Bevis' Thumb			Drewett 1981, 24	*I-11843*
Orton Meadows	2nd alignment			*UB-3248*
Barleycroft Paddocks	F463		C. Evans *et al.* 1999	*OxA-8108*
Briar Hill			Bamford 1985, figs 52–55	*build Briar Hill*
Etton			Pryor 1998, figs 175–201	Between *start Etton* and *end Etton*
Grendon	Area C ring ditch V		Gibson and McCormick 1985, figs 18–20	*HAR-1497*, *HAR-1498*, *HAR -1495*?
Haddenham enclosure			Gdaniec 2006, fig. 5.32: 1–6	Between *start Haddenham* and *end Haddenham*
Haddenham long barrow	Phase I, close to posthole of façade; Phase III		Knight 2006a, fig. 3.58:P1, P2, fig. 3.60)	*HAR-9173*, *HAR -9176*, *Haddenham LB*
Kilverstone			Garrow *et al.* 2006, figs 2.15–2.32	Between *start Kilverstone* and *end Kilverstone*
Maiden Bower			Piggott 1931, fig. 6; Matthews 1976, 8–9	Between *start Maiden Bower* and *end Maiden Bower*
Parnwell				*NZA-24076, -24077*
Whiteleaf			Childe and Smith 1954, figs 5–7	*NZA-21036*
South-central				
Abingdon			Avery 1982, Figs 14–19, Case 1956, figs 3–4	Between *start Abingdon* and *end Abingdon*
St Helen's Avenue, Benson			Pine and Ford 2003, fig. 10, fig. 11: 20–24	*KIA-9530, -9531*
Eton Wick			Ford 1993, microfiche	Between *start Eton Wick* and *end Eton Wick*
Fussell's Lodge	Under/in bone group A		Ashbee 1966, fig. 5: W1	Between *build_box* and *extend_box*
Fussell's Lodge	At proximal end of 'collapsed mortuary house'		Ashbee 1966, figs 5–6: W2–W9	*Build_barrow*
Hambledon Hill		Yes	I. Smith 2008a, figs 9.8, 9.9	Between *start Hambledon* and *end Hambledon*
Hazleton	Hearth on top of primary fill of S quarry		Smith and Darvill 1990, fig. 157:32	Between *start Hazleton* and *end Hazleton*
Hemp Knoll	Pits beneath barrow		M. Robertson-Mackay 1980, fig. 4: P1–P5	*HAR-2997*

Site	Sub-division	South-Western element in assemblage	Illustrations or descriptions	Distribution
Knap Hill		Yes	Connah 1965, fig. 6: 1–7	Between *start Knap Hill* and *end Knap Hill*
Pits outside Robin Hood's Ball		Yes	J. Richards 1990, 61	*OxA-1400, OxA-1401*
Peak Camp			Darvill 1981; 1982a	Between *start Peak Camp* and *end Peak Camp*
Runnymede Bridge			Needham 1991, figs 67–69	Between *start Runnymede occupation* and *end Runnymede occupation*
South Stoke			Timby *et al.* 2005, fig. 19: 1–11	*NZA-18463* to *NZA-18466, NZA-18502*
Staines			R. Robertson-Mackay 1987, figs 38–55	between *start Staines* and *end Staines*
West Kennet long barrow			Piggott 1962, fig. 10	between *start West Kennet primary* and *end West Kennet primary*
Windmill Hill		Yes	I. Smith 1965a, figs 14–29	Between *start Windmill Hill* and *end Windmill Hill*
South-west				
Cwm Meudwy, Llandysul			Murphy and Evans 2005	*Beta-185679, Beta-185680*
Ty Isaf	All chambers except IV (rotunda = chamber III)		Grimes 1939, fig. 6	Between *start Ty Isaf rotunda* and *end Ty Isaf rotunda*
Wellington Quarry			Jackson and Miller forthcoming	*OxA-12547, OxA-12568 to OxA-12570*
Bromfield	F247		Stanford 1982, fig. 5: 55–59	*HAR-3968*

assemblages and classic Carinated Bowl ones, although closer to the former (Wainwright 1972, figs 25–45; Herne 1988; Cleal 1992). At Broome Heath, the assemblage predates the enclosure by a substantial interval (Chapter 6), and, although miscellaneous plain wares are associated with other enclosures, none of these is a classic causewayed enclosure. They comprise the atypical, ill-defined circuit at Gatehampton Farm, Goring (Fig. 8.10), the incompletely enclosing ditches of Etton Woodgate (Fig. 6.35), and possibly the continuous enclosure in Hill Croft Field, Herefordshire, the pottery from which is so far (2009) unpublished. The pits at Broome Heath and an irregular hollow at Cherhill, Wiltshire (Evans and Smith 1983), are more typical of the contexts of this group of material.

A model for the currency of plain Bowl in southern Britain is shown in Fig. 14.90. This estimates that plain Bowl assemblages first appeared in southern Britain in *3970–3715 cal BC* (*95% probability*; Fig. 14.90: *start plain Bowl*), probably in *3855–3730 cal BC* (*68% probability*). They ceased to be deposited in southern Britain in *3475–3385 cal BC* (*8% probability*; Fig. 14.90: *end plain Bowl*) or *3375−3095 cal BC* (*87% probability*), probably in *3355–3210 cal BC* (*68% probability*). Although the category is composite, a couple of points can be made. In areas where Carinated Bowl occurs, other traditions were already present in the first quarter of the fourth millennium cal BC. The earlier assemblages probably include the 40 or so vessels at from the Coneybury Anomaly, singled out as distinctive by both Cleal (2004, 171–3) and Pailler and Sheridan (2009, 14–15), whether or not they reflect the north-west French connection suggested by the last two authors. This is so far dated only by a *terminus post quem*, measured on disarticulated animal bone (Fig. 14.90: OxA-1402); the probability that the deposit in question was dumped in a single event suggests, however, that the date may be close to the age of the assemblage, and the presence of articulated animal bone renders this verifiable (Chapter 4). If dates measured on bulk charcoal samples in the 1970s provide reliable *termini post quos*, then, in eastern England at least, some assemblages produced towards the end of the currency of Bowl pottery included those characterised by rounded forms, less emphatic rims than those of decorated assemblages, and rare rilling or fluting, as at Broome Heath and Padholme Road, Fengate (Fig. 14.90: *BM-756−7, GaK-4197*).

Decorated Bowl. Regional styles of Decorated Bowl were defined by Piggott (1954, 70–75) and adumbrated by I. Smith (1956) on the basis of a far smaller corpus of material than is now available. As more and more assemblages have been excavated, the Windmill style of north Wessex, the Abingdon style of the Thames valley, the Mildenhall style of East Anglia and the Whitehawk style of Sussex have tended to grade into each other, and Whittle's Decorated style, encompassing them all (1977b, 85–94), seems increasingly realistic. The assemblages are characterised by closed as well as neutral and sometimes open forms, both shouldered and unshouldered profiles, the former often with ledge-like shoulders, heavy rims, and

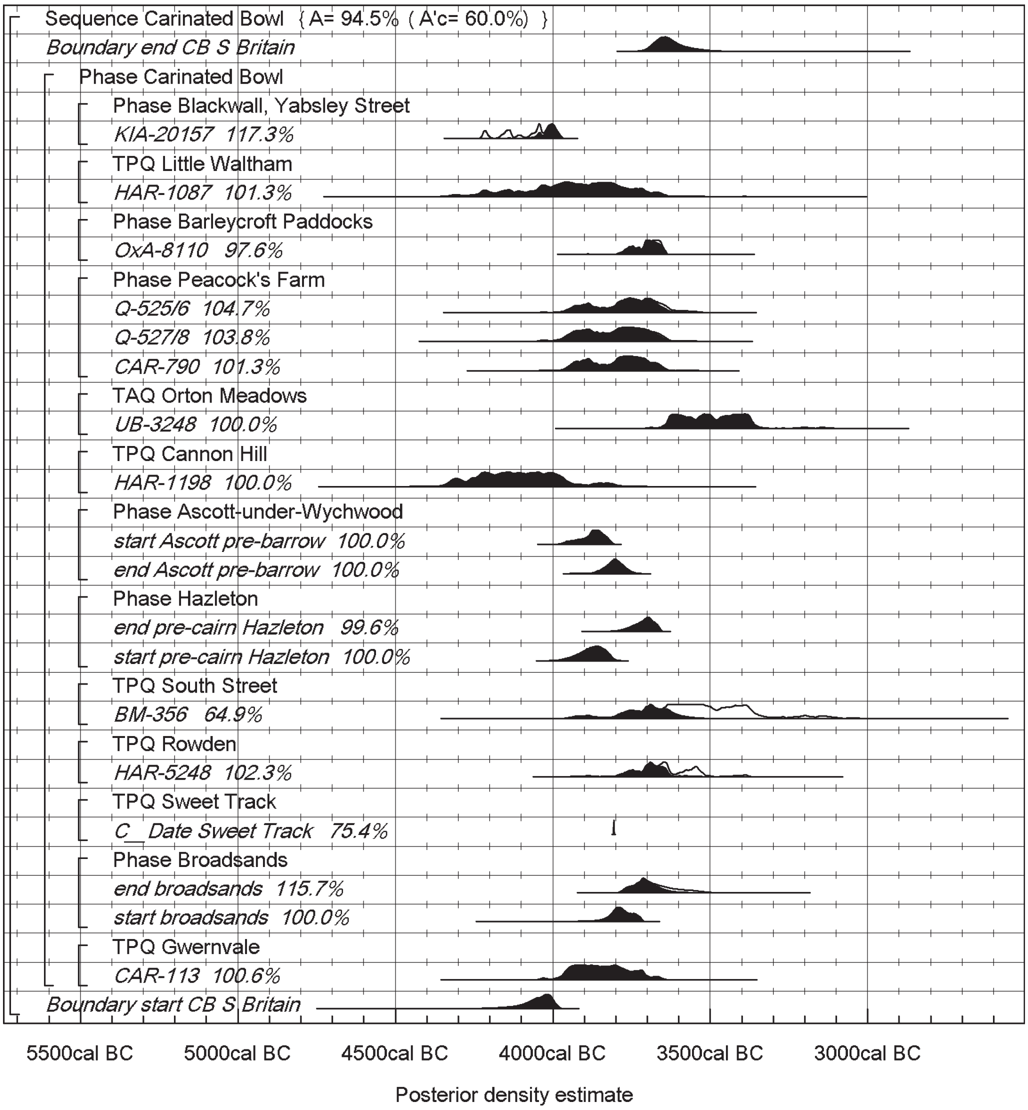


Fig. 14.88. Probability distributions of dates associated with Carinated Bowl pottery from southern Britain. The format is the same as for Fig. 14.1. Distributions have been taken from the models defined in Fig. 6.18 (Peacock's Farm) and Fig. 10.30 (Broadsands), and by Meadows et al. *(2007, figs 6–9) (Hazleton) and Bayliss* et al. *(2007c, figs 3 and 5–7) (Ascott-under-Wychwood). The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.*

decoration, generally linear and punctiform, on a minority of vessels (Fig. 14.91). This is classically the style found in causewayed enclosures, except in the south-west peninsula and adjoining areas, the only part of southern Britain from which it seems to be absent. There are numerous other occurrences, notably in pits.

In Wessex, where the distributions of Decorated and South-Western styles overlap, there is a particular diversity of assemblages, some combining elements of both. The largest such are from Hambledon Hill, in which there is a small Decorated element in a largely South-Western assemblage (I. Smith 2008a), and Windmill Hill where the Decorated element is dominant (I. Smith 1965a, 59–73; Zienkiewicz and Hamilton 1999, 286–7). In these cases, the relevant dates are included in the models for both the Decorated and South-Western styles, as indicated in Tables 14.9–10.

The overall structure of a model for the currency of Decorated Bowl in southern Britain is shown in Fig. 14.92. Since there are enough data to enable the currency of this tradition to be dated in different areas, the component section for south-east England is given in Figs 14.94–5, that for south-central England in Figs 14.97–8, and that for south-west Britain (in this case Wales and the Marches only) in Fig. 14.99. This model estimates that Decorated Bowl first appeared in southern Britain in *3745–3690 cal BC* (*95% probability*; Fig. 14.92: *start Decorated*), probably in *3730–3700 cal BC* (*68% probability*), and ended in southern Britain in *3315–3245 cal BC* (*95% probability*; Fig. 14.92: *end Decorated*), probably in *3305–3270 cal BC* (*68% probability*).

The model for the currency of Decorated Bowl in south-east England is given in Figs 14.93–5. This estimates that the tradition began in this area in *3780–3685 cal BC* (*95%

Table 14.10. South-Western style pottery associated with the dates shown in Figs 14.101–6.

Site	Sub-division	Decorated element in assemblage	Gabbroic fabrics present	Drawings	Distribution
South-central					
Knap Hill		Yes		Connah 1965, fig. 6: 1–7	Between *start Knap Hill* and *end Knap Hill*
Windmill Hill		Yes	Yes		Between *start Windmill Hill* and *end Windmill Hill*
Hambledon Hill		Yes	Yes	I. Smith 2008a, figs 9.1–9.9	Between *start Hambledon* and *end Hambledon*, gabbroic fabrics present from *Hambledon S long barrow*
Robin Hood's Ball			Yes	N. Thomas 1964a, fig. 4	Between *start Robin Hood's Ball* and *end Robin Hood's Ball*
Pits outside Robin Hood's Ball		Yes		J. Richards 1990, 61 (verbal description only)	*OxA-1400*, *OxA-1401*
Flagstones	Pits 221, 274			Cleal 1997, fig. 64: 14–16	*HAR-9161*
Maiden Castle			Yes	Cleal 1991, fig. 141:1, 2, 4, 5, 7; Wheeler 1943, figs 26–37	South-Western: from *start Maiden enclosure* to end *Maiden long mound*; gabbroic fabrics from *start Maiden enclosure* to *end Maiden enclosure*, with direct residue dates on sherds: *GrA-29111, 553*; *OxA-X-2135-46*
Thickthorn Down				Drew and Piggott 1936, pl. XXII: upper	*BM-2355*
Whitesheet Hill			Yes	Cleal 2004, fig. 9	South-Western between *start Whitesheet Hill* and *end Whitesheet Hill*; gabbroic fabrics between *start Whitesheet Hill* and *GrA-30067*
South-west					
Broken Cavern					*OxA-3205*, *OxA-3206*, *OxA-3207*
Carn Brea			Yes	Mercer 1981a, figs 66–74	Between *start Carn Brea* and *end Carn Brea*
Hazard Hill			Yes	Houlder 1963, fig. 7, upper	*BM-149*, *BM-150*
Helman Tor			Yes	Mercer 1997, figs 7–8	South-Western between *start Helman Tor* and *end Helman Tor*; gabbroic fabrics also *HT86 697*
Hembury			Yes	Liddell 1931, pl. XXVII; 1932, pl. XVIII; 1935, pls XXXVI, XXXVII	Between *start Hembury* and *end Hembury*
High Peak		South-Western	Yes	S. Pollard 1966, fig. 9: 1–7	*BM-214*
Penhale Round		South-Western	Yes		South-Western: *Wk-9839,Wk-9840*; gabbroic farbrics: *Wk-9839*
Poldowrian	Pit 106	South-Western		Smith and Harris 1982	*HAR-4323*
Portscatho		South-Western	Yes	Jones and Reed 2006, fig. 4	South-Western: *Wk-13256, Wk-13257, Wk-13258, Wk-13259*; gabbroic fabrics: *Wk-13256, Wk-13258, Wk-13259*
Raddon		South-Western	Yes		Between *start Raddon* and *end Raddon*
Tregarrick		South-western	Yes	Cole and Jones 2003, figs 4–5	South-Western: *WK-14913, Wk-14915 to Wk-14917*; gabbroic fabrics *Wk-14913, Wk-14915, Wk-14916, Wk-14917, Wk-14918*

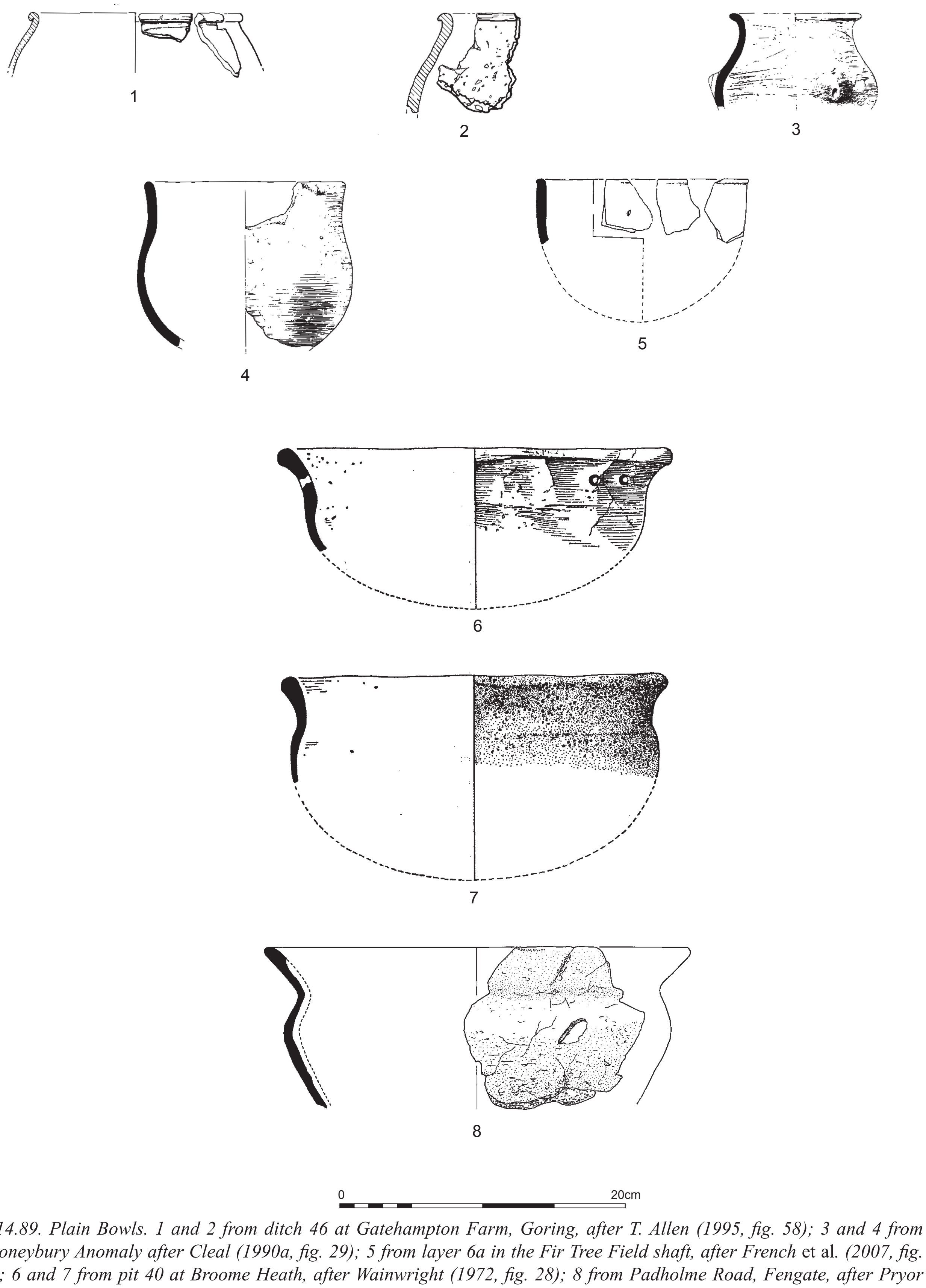


Fig. 14.89. Plain Bowls. 1 and 2 from ditch 46 at Gatehampton Farm, Goring, after T. Allen (1995, fig. 58); 3 and 4 from the Coneybury Anomaly after Cleal (1990a, fig. 29); 5 from layer 6a in the Fir Tree Field shaft, after French et al. *(2007, fig. A4.7); 6 and 7 from pit 40 at Broome Heath, after Wainwright (1972, fig. 28); 8 from Padholme Road, Fengate, after Pryor (1974, fig. 6).*

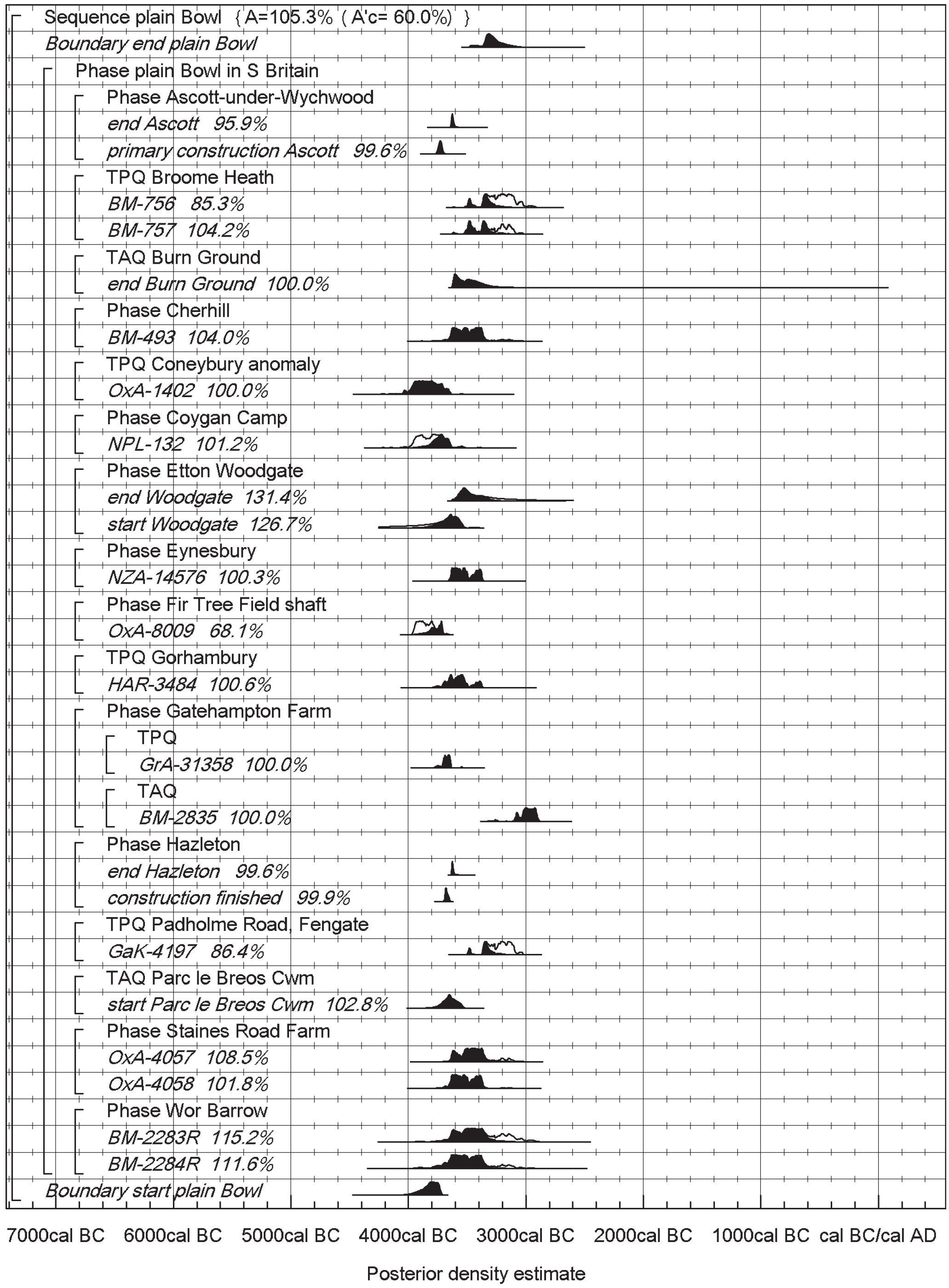


Fig. 14.90. Probability distributions of dates associated with plain Bowl pottery from southern Britain. The format is the same as for Fig. 14.1. Distributions have been taken from the models defined in Fig. 4.21 (Fir Tree Field shaft), Fig. 6.36 (Etton Woodgate), Fig. 9.25 (Burn Ground), and Fig. 11.13 (Parc le Breos Cwm) and by Meadows et al. *(2007, figs 6–9) (Hazleton) and Bayliss* et al. *(2007c, figs 3 and 5–7) (Ascott-under-Wychwood). The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.*

probability; Fig. 14.93: *start Decorated SE*), probably in *3745–3700 cal BC* (*68% probability*). In this area, the tradition ended in *3310–3185 cal BC* (*95% probability*; Fig. 14.93: *end Decorated SE*), probably in *3295–3225 cal BC* (*68% probability*).

The model for the currency of Decorated Bowl in south-central England is defined in Figs 14.96–8. This estimates that the tradition began in this area in *3770–3670 cal BC* (*95% probability*; Fig. 14.96: *start Decorated S central*), probably in *3735–3685 cal BC* (*68% probability*). In this area, the tradition ended in *3335–3245 cal BC* (*95% probability*; Fig. 14.96: *end Decorated S central*), probably in *3325–3285 cal BC* (*68% probability*).

The model for the currency of Decorated Bowl in south-west Britain (Wales and the Marches only) is defined in Fig. 14.99. Because dated occurrences of the tradition

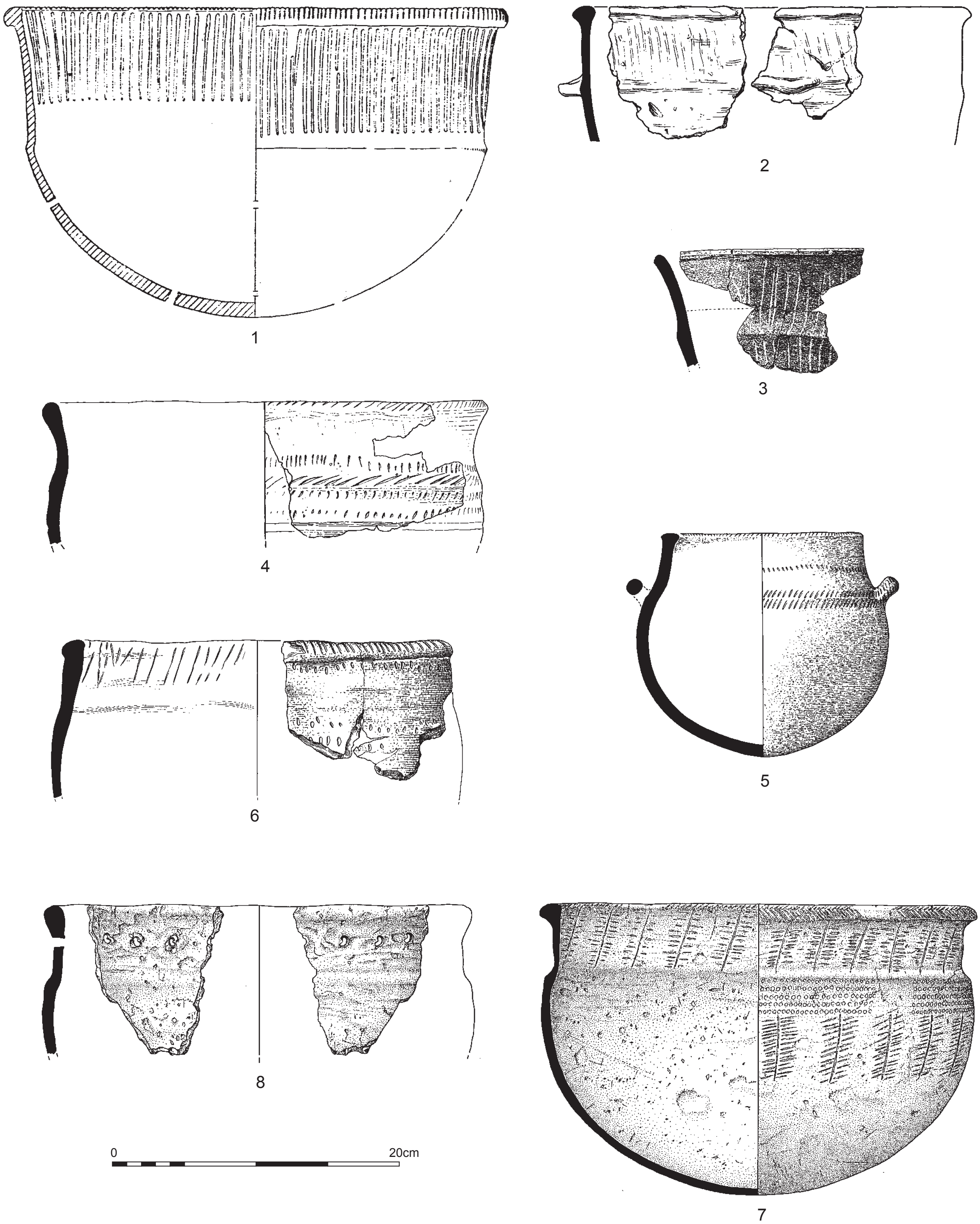


Fig. 14.91. Decorated Bowl pottery. 1 from Windmill Hill, after I. Smith (1965a, fig. 26); 2 from the inner ditch at Abingdon, after Avery (1982, fig.15); 3 from spit 5 in cutting VIII in ditch 3 at Whitehawk, after Curwen (1934a, fig. 5); 4 from segment 9 of the inner ditch of Kingsborough 1, after M. Allen et al. *(2008, fig. 8); 5 from the base of the SE butt of segment 1, and 6 from near the base of the same segment towards the NW butt at Etton, after Pryor (1998, figs 175, 177); 7 and 8 from pit cluster B at Kilverstone, after Garrow* et al. *(2006, fig. 2.16).*

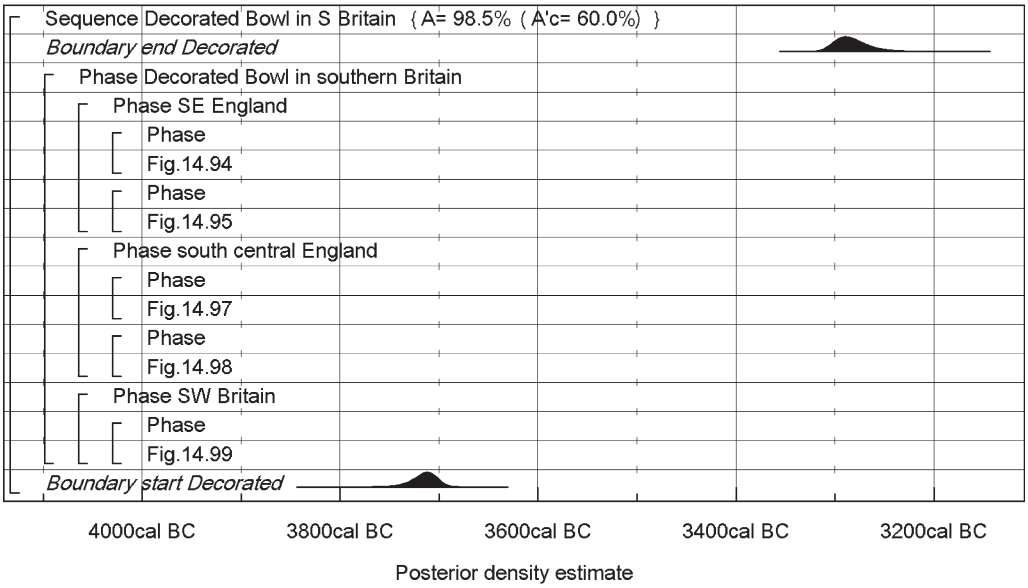


Fig. 14.92. Overall structure of the chronological model for the currency of Decorated Bowl pottery in southern Britain. The component sections of this model are shown in detail in Figs 14.94–5 and 14.97–8, and within the uniform phase boundaries of Fig. 14.99 (although the posterior density estimates shown on these figures are not those relating to this model). The large square brackets down the left-hand side of the figures, along with the OxCal keywords, define the overall model exactly.

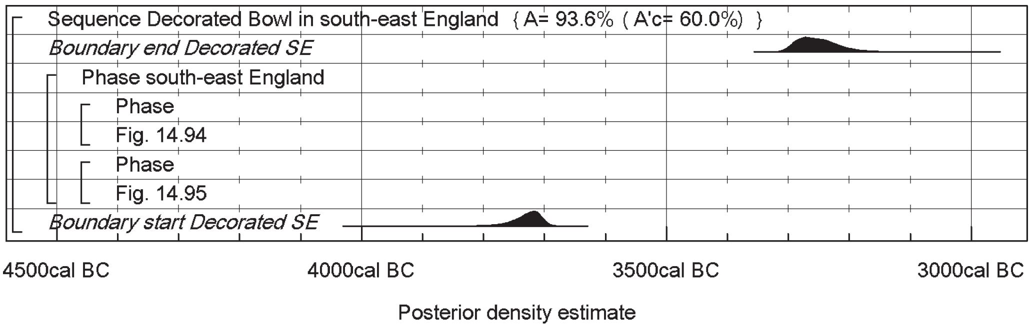


Fig. 14.93. Overall structure of the chronological model for the currency of Decorated Bowl pottery in south-east England. The component sections of this model are shown in detail in Figs 14.94–5. The large square brackets down the left-hand side of the figures, along with the OxCal keywords, define the overall model exactly.

are rare here, on the edge of its geographical range, the distributions have extremely long tails. The model estimates that Decorated Bowl first appeared in this area in *3985–3630 cal BC* (*95% probability*; Fig. 14.99: *start Decorated SW*), probably in *3770–3645 cal BC* (*68% probability*). In this area, the tradition ended in *3355–2965 cal BC* (*95% probability*; Fig. 14.99: *end Decorated SW*), probably in *3340–3185 cal BC* (*68% probability*).

South-Western. The South-Western style (or Hembury Ware) is distinguished by bag-shaped forms, simple rims, a variety of lugs, including horizontally perforated ones, and cordons. Shouldered or carinated forms and decoration are both rare (Fig. 14.100). It is the overwhelmingly dominant tradition in the south-west peninsula, occurring in all kinds of contexts, and is found in significant quantities in adjacent parts of Wessex. The assemblage from two pits predating the Flagstones enclosure, Dorset (Cleal 1997, fig. 64: 2–16), is here treated as a South-Western one (*contra* Cleal 2004, 173; Pailler and Sheridan 2009, 14). Typologically, the assemblage falls within the range of the South-Western style (Cleal 1997, 96–98), and even the one vessel that could be described as carinated (Cleal 1997, fig. 64: 8) can be matched among, for example, some of the rarer forms at Carn Brea (I. Smith 1981, fig. 68).

The overall structure of the model for the currency of South-Western style pottery in southern Britain is shown in Fig. 14.101, with its component sections given in Figs 14.102−3. This model estimates that South-Western style pottery first appeared in southern Britain in *3810–3690 cal BC* (*95% probability*; Fig. 14.101: *start South Western style*), probably in *3770–3705 cal BC* (*68% probability*). The tradition ended in southern Britain in *3340–3275 cal BC* (*95% probability*; Fig. 14.101: *end South Western style*), probably in *3335–3300 cal BC* (*68% probability*).

Gabbroic fabrics. It was recognised from the 1930s onwards that some of the finer South-Western style pots

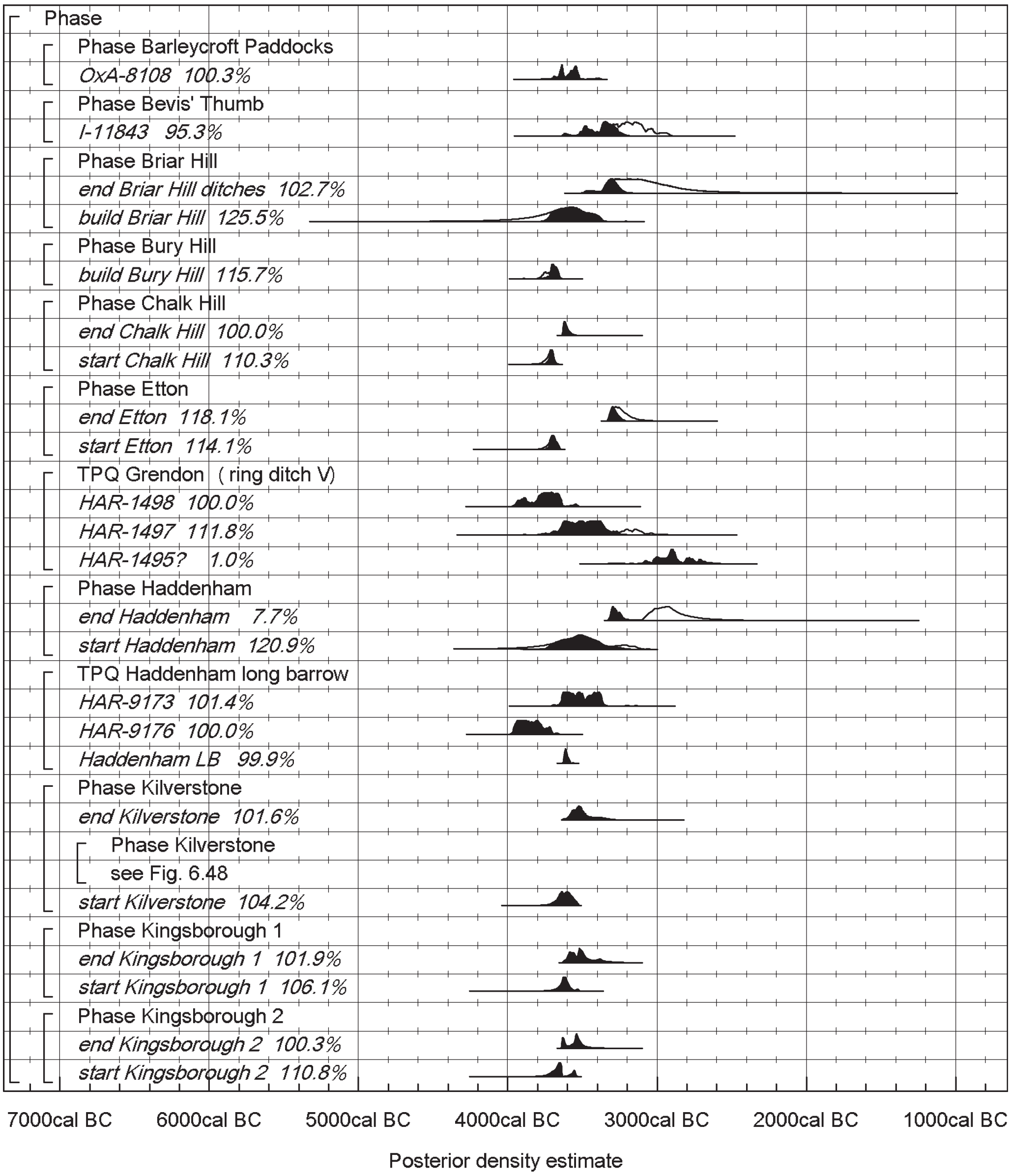


Fig. 14.94. Probability distributions of dates for Decorated Bowl pottery in south-east England. The sub-component of the model relating to pits at Kilverstone is shown in Fig. 6.48 (although the posterior density estimates shown on this figure are not those relating to this model). The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Fig. 5.25 (Bury Hill), Fig. 6.33 (Etton), Fig. 6.23 (Briar Hill), Fig. 6.11 (Haddenham), Figs 6.16–17 (Haddenham long barrow), Fig. 7.21 (Chalk Hill), and Figs 7.15 and 7.17 (Kingsborough 1 and 2). The overall structure of this model is shown in Fig. 14.93, and its other component in Fig. 14.95.

at sites outside Cornwall were made of non-local clay, the temper in which resembled the material of stone axeheads, as at Hembury (Liddell 1935, 162–3) and Windmill Hill (I. Smith 1965a, 44). This was subsequently identified as gabbroic ware, the clay for which derives from the Lizard peninsula in south-west Cornwall (Peacock 1969). Progressive identifications have confirmed transport as far as Wessex but not beyond, the proportion in any assemblage diminishing eastward. A connection with causewayed enclosures is reinforced, since such fabrics tend to be present even in small assemblages from limited excavations, as at Robin Hood's Ball or Whitesheet Hill. It is surely significant that, of the dated assemblages including gabbroic fabrics listed in Table 14.10, non-enclosure contexts occur only in Cornwall and Devon, relatively close to the source. It is also noticeable that the gabbroic vessels found in Wessex enclosures tend to lie at the large end of the size range encountered at, for example, Carn Brea.

The overall structure of the model for the currency of gabbroic fabrics within South-Western style pottery is shown in Fig. 14.104, with its component sections given in Figs 14.105–6. This model estimates that gabbroic fabrics first appeared in *3800–3670 cal BC* (*95% probability*; Fig. 14.104: *start gabbroic*), probably in *3755–3685 cal BC* (*68% probability*). They ceased to be employed in the South-Western style in *3550–3415 cal BC* (*95%*

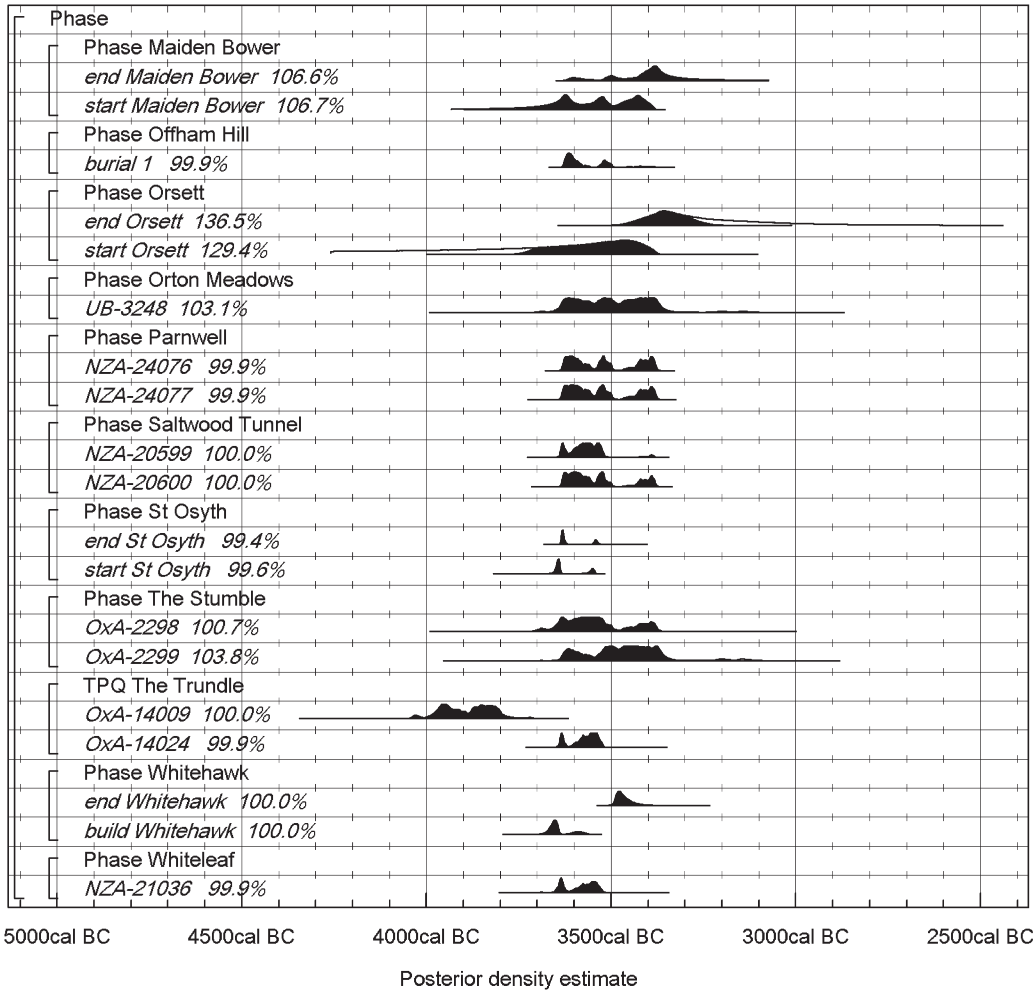


Fig. 14.95. Probability distributions of dates for Decorated Bowl pottery in south-east England. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Fig. 5.14 (Offham Hill), Figs 5.5–9 (Whitehawk), Fig. 6.4 (Maiden Bower), Fig. 7.10 (Orsett) and Fig. 7.6 (St Osyth). The overall structure of this model is shown in Fig. 14.93, and its other component in Fig. 14.94.

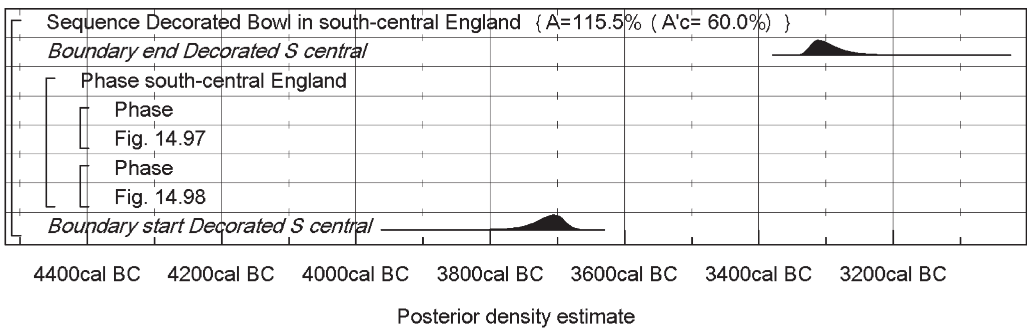


Fig. 14.96. Overall structure of the chronological model for the currency of Decorated Bowl pottery in south-central England. The component sections of this model are shown in detail in Figs 14.97–8. The large square brackets down the left-hand side of the figures, along with the OxCal keywords, define the overall model exactly.

probability; Fig. 14.104: *end gabbroic*), probably in *3545–3530 cal BC* (*10% probability*) or *3490–3440 cal BC* (*58% probability*). In this model, dates which are directly associated with gabbroic vessels are included as dates for the currency of this fabric. For sites where we have gabbroic pottery in stratified early Neolithic deposits, which have not been directly dated themselves, however, we have only concluded that this material must have been deposited after the site was established and before its primary use ended. Given the rarity of this type of material, this modelling approach allows for the fact that it reached the site at some time during its use, not necessarily during the whole period

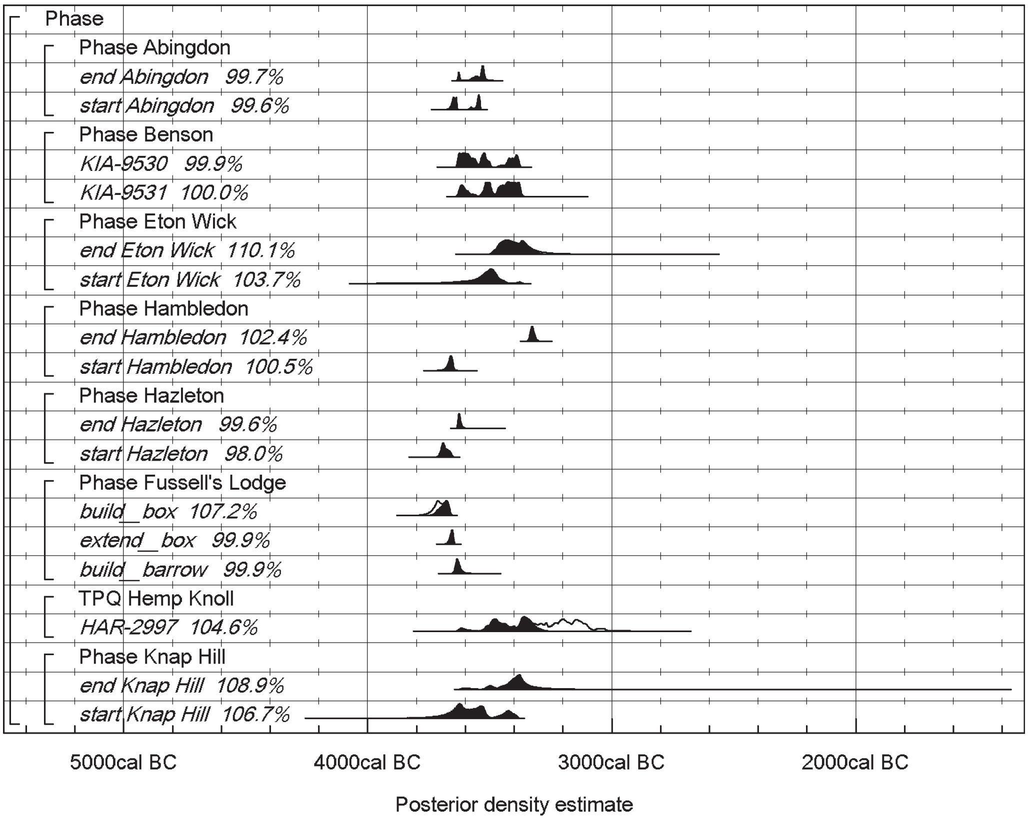


Fig. 14.97. Probability distributions of dates for Decorated Bowl pottery in south-central England. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Fig. 3.25 (Knap Hill), Figs 4.7–13 (Hambledon Hill), Fig. 8.5 (Eton Wick), Figs 8.18–21 (Abingdon), and by Meadows et al. *(2007, figs 6–9) (Hazleton) and Wysocki* et al. *(2007, fig. 10) (Fussell's Lodge). The overall structure of this model is shown in Fig. 14.96, and its other component in Fig. 14.98.*

of this. This approach has also been used for modelling the chronology of the ground stone axeheads, which likewise occur in small numbers.

Figure 14.107 shows the currency of the different Bowl traditions in southern Britain. It is *99% probable* that Carinated Bowl appeared first, and *99% probable* that Decorated Bowl appeared after Carinated and some plain Bowl assemblages. It is *100% probable* that Carinated Bowl went out of use before the other types of Bowl pottery considered here. Decorated Bowl and plain Bowl went out of use more or less together in the decades around 3300 cal BC. It is *100% probable* that plain Bowl was in use before the disappearance of Carinated Bowl, and it is *99% probable* that Decorated Bowl had also appeared before the demise of pottery in the Carinated Bowl tradition. There was a probably fairly restricted period at the end of the 38th and in the earlier part of the 37th century cal BC when all three traditions were current. For example, the period between the introduction of Decorated Bowl and the disappearance of Carinated Bowl lasted for *1–215 years* (*95% probability*; Fig. 14.108: *end CB/start Decorated*), probably for *25–125 years* (*68% probability*).

Decorated Bowl appeared very quickly across much of southern Britain, beginning in the later part of the 38th century cal BC and ending in the latter part of the 34th or the 33rd century cal BC (Fig. 14.109). South-Western style pottery has a very similar currency (Fig. 14.110), although it seems to have begun a generation or two earlier than Decorated Bowl: *−35−100 years* (*95% probability*; Fig. 14.108: *South Western/Decorated*), probably *−10−55 years* (*68% probability*). In south-western Britain, the first pottery may have been in the South-Western style, although it is possible that ceramics in another tradition, Carinated or plain Bowl, may appear slightly earlier in this area. If there was earlier pottery in this area, the gap between it and the appearance of the South-Western style was very brief: only *−65−105 years* (*95% probability*; Fig. 14.111: *SW pots/South Western*), probably *−20−65 years* (*68% probability*). Gabbroic fabrics were probably used from the start of the South-Western style (Figs 14.110−11).

Figure 14.112 shows the dates of the first Neolithic things and practices in each area of southern Britain, along with the date of the first enclosure, the date of the first pottery and the date of the appearance of Decorated Bowl in each area. The appearances of South-Western Pottery and gabbroic fabrics are also shown. The first Neolithic things and practices including Carinated Bowl began in south-east England in the 41st century cal BC. Pottery and other early Neolithic things and practices, possibly including Plain, non-carinated, Bowl, spread to south-central England during the 40th and 39th centuries cal BC. It is apparent that the 38th century cal BC was a period of

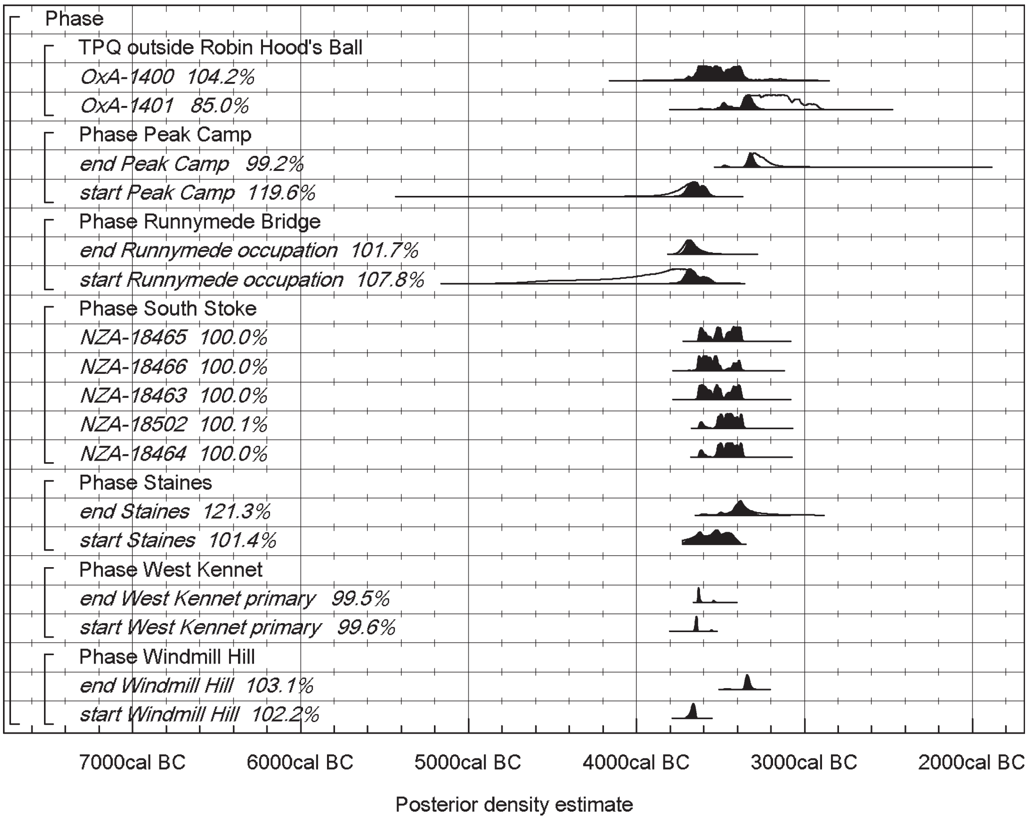


Fig. 14.98. Probability distributions of dates for Decorated Bowl pottery in south-central England. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Figs 3.8–11 (Windmill Hill), Fig. 8.3 (Staines), Fig 8.6 (Runnymede), Fig. 9.19 (Peak Camp) and by Bayliss et al. *(2007b, fig. 6) (West Kennet). The overall structure of this model is shown in Fig. 14.96, and its other component in Fig. 14.97.*

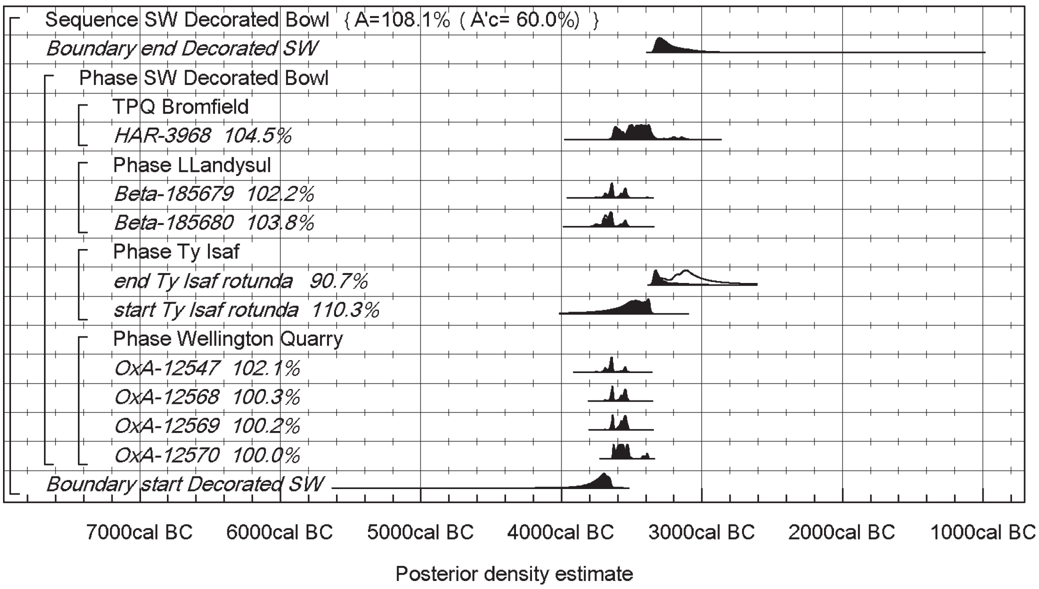


Fig. 14.99. Probability distributions of dates associated with Decorated Bowl pottery from south-west Britain. The format is the same as for Fig. 14.1. Distributions have been taken from the model defined in Fig. 11.14 (Ty Isaf). The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the model exactly.

innovation. Neolithic things and practices spread to south-west Britain. During this century these included pottery, and the South-Western style together with gabbroic fabrics. Slightly later came the first enclosures in the south-west peninsula, and the first Decorated pottery in Wales and the Marches. Elsewhere, the last decades of the century saw the appearance of Decorated Bowl, and in south-east England at least, the first causewayed enclosures. The first

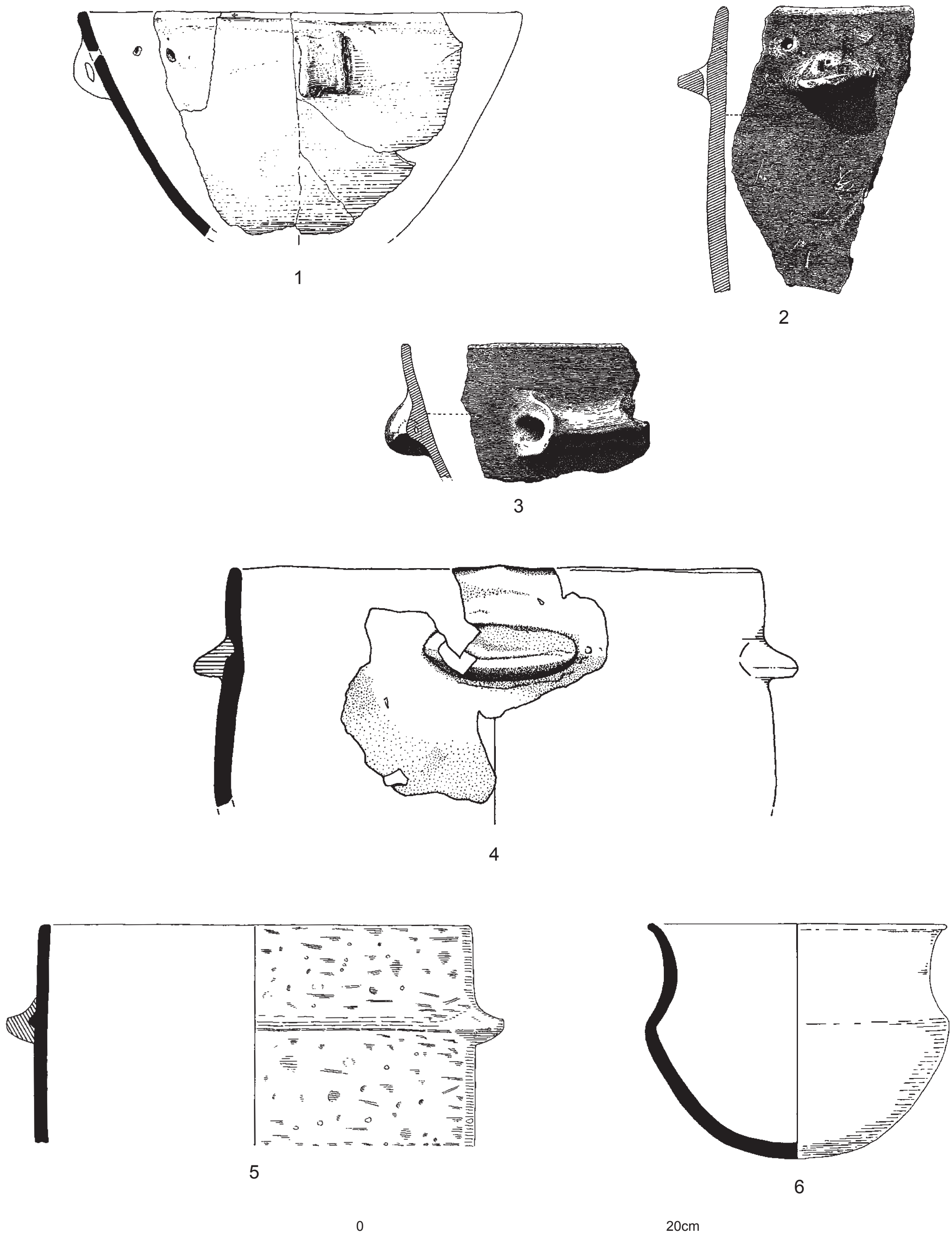


Fig. 14.100. South-Western style Bowls. 1 gabbroic ware vessel from a loam intercalated with the 'midden' layers in the inner ditch at Maiden Castle, after Cleal (1991, fig. 141), carbonised residue from this pot is dated by OxA-X-213-46 (Table 4.9; Fig. 4.42); 2 and 3 from Hembury, after Liddell (1931, pl. XXVII); 4 from pit 45 at Tregarrick Farm, after Cole and Jones (2003, fig. 5); 5 from Carn Brea, after I. Smith (1981, fig.72); 6 from Helman Tor, after I. Smith (1997, fig. 7); carbonised residue from this pot is dated by GrA-31319 and OxA-15631 (Table 10.3; Figs 10.21, 10.22: R_Combine HT86 697*).*

appearance of enclosures in south-central England may have been a few decades later.

The pattern of emergence of the different pottery traditions is summarised in Fig. 14.113, along with our estimate for the date of the first causewayed and related enclosures in southern Britain. The start of both the Carinated and plain Bowl traditions is earlier than the beginning of enclosures, but enclosures and Decorated Bowl appear at more or less the same time at the end of the 38th century cal BC. If there is any lag between these

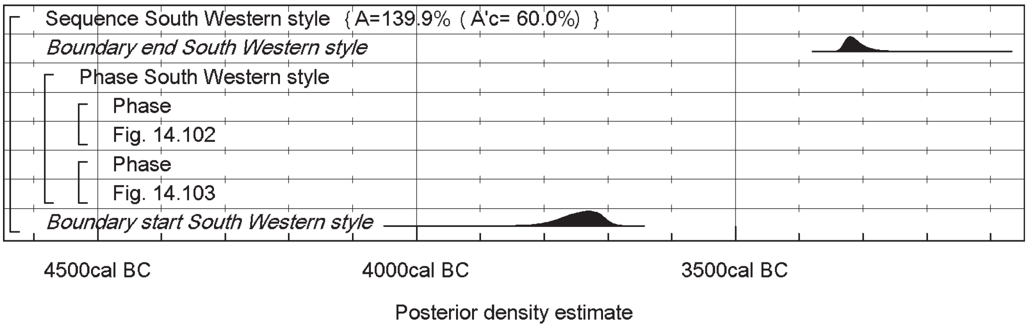


Fig. 14.101. Overall structure of the chronological model for the currency of South-Western style pottery in southern Britain. The component sections of this model are shown in detail in Figs 14.102–3. The large square brackets down the left-hand side of the figures, along with the OxCal keywords, define the overall model exactly.

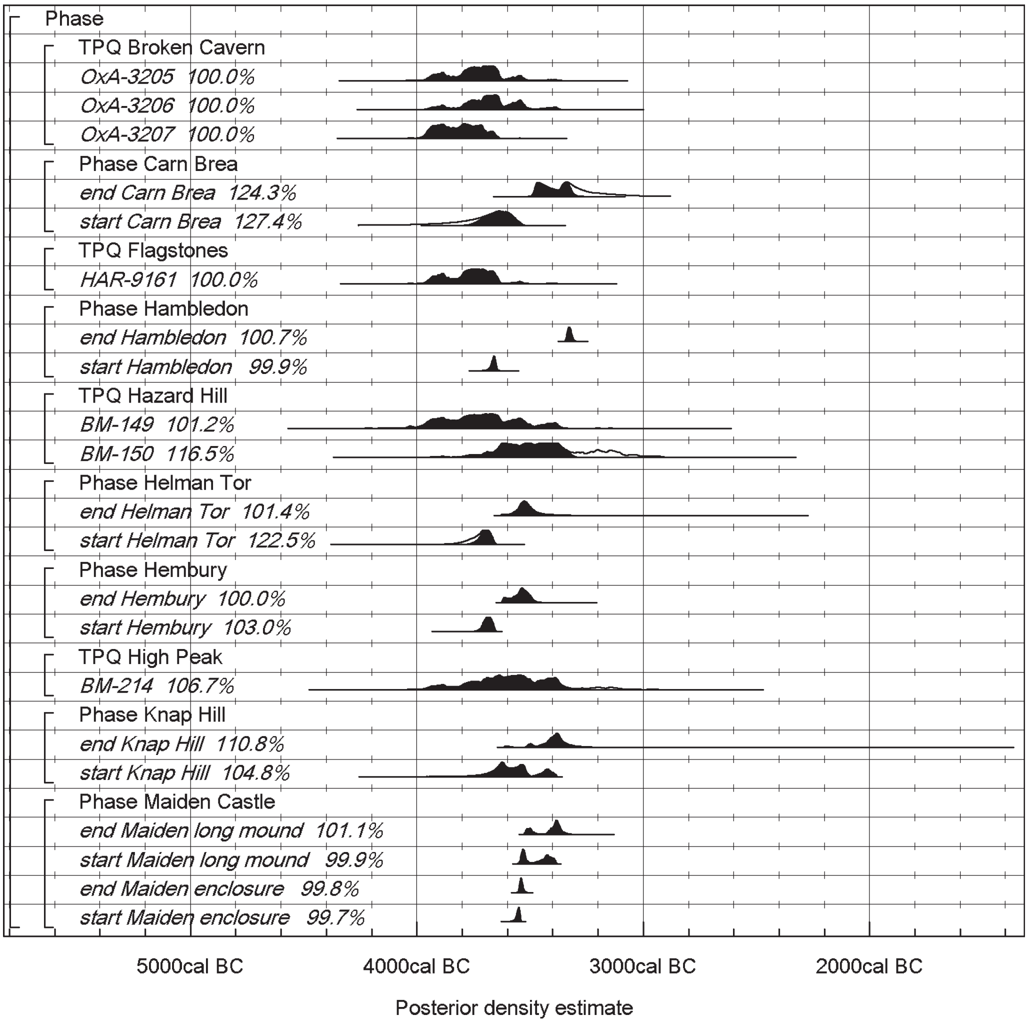


Fig. 14.102. Probability distributions of dates for South-Western style pottery in southern Britain. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Fig. 3.25 (Knap Hill), Figs 4.7–13 (Hambledon Hill), Figs 4.41–5 (Maiden Castle), Figs 10.9–12 (Hembury), Fig. 10.22 (Helman Tor), and Fig. 10.25 (Carn Brea). The overall structure of this model is shown in Fig. 14.101, and its other component in Fig. 14.103.

two phenomena, then Decorated Bowl may have appeared with the intensification of circuit construction, rather than with the first flush of enclosure (Fig. 14.108: *start enclosures/Decorated*; compare Fig. 14.14).

The chronological sequence of emergence of pottery styles in Fig. 14.113 conforms to several stratigraphic sequences. At the Ascott-under-Wychwood and Hazleton long cairns, Carinated Bowl assemblages sealed beneath

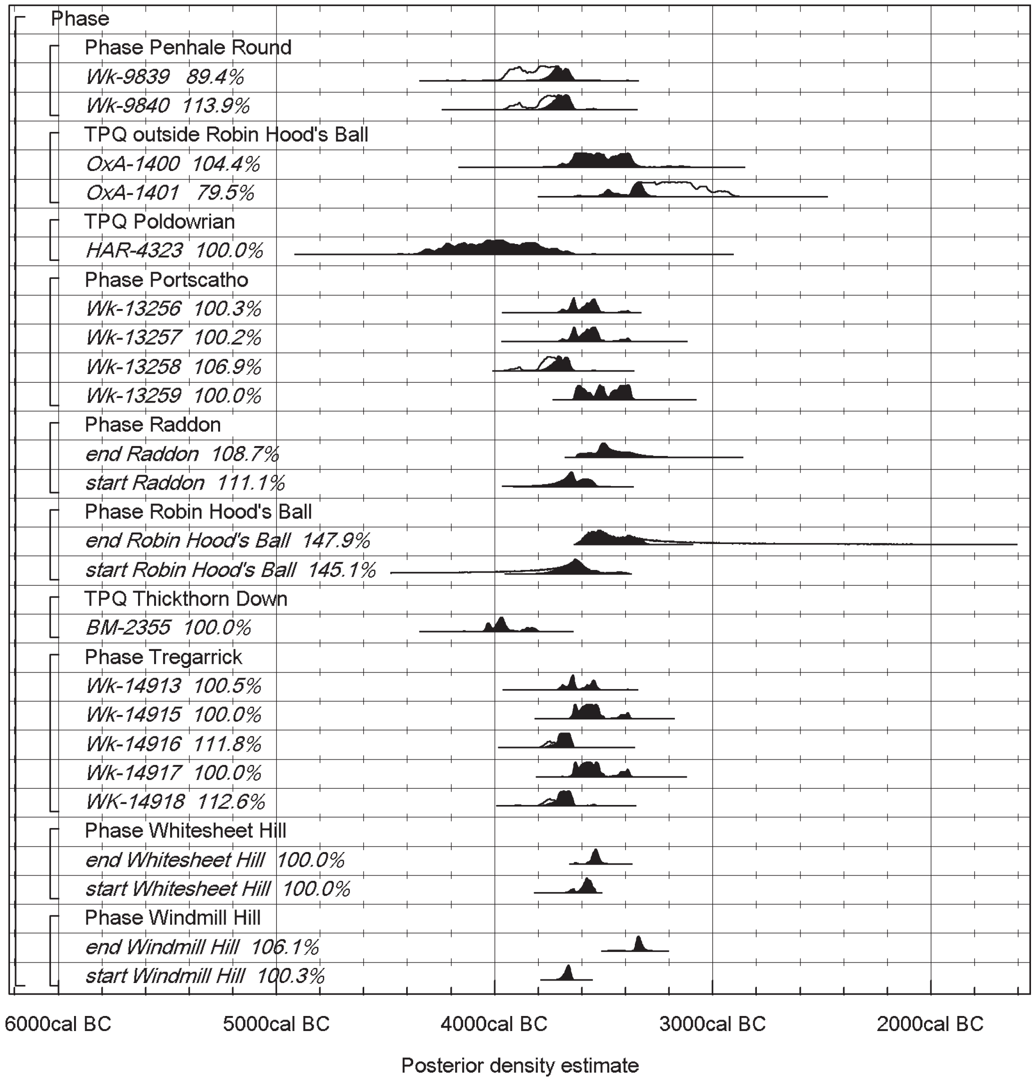


Fig. 14.103. Probability distributions of dates for South-Western style pottery in southern Britain. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Figs 3.8–11 (Windmill Hill), Fig. 4.26 (Whitesheet Hill), Fig. 4.51 (Robin Hood's Ball), and Fig. 10.16 (Raddon). The overall structure of this model is shown in Fig. 14.101, and its other component in Fig. 14.102.

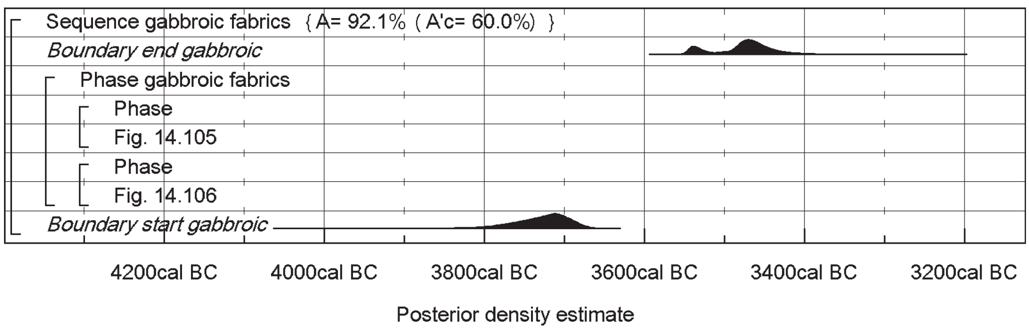


Fig. 14.104. Overall structure of the chronological model for the currency of gabbroic pottery fabrics in southern Britain. The component sections of this model are shown in detail in Figs 14.105–6. The large square brackets down the left-hand side of the figures, along with the OxCal keywords, define the overall model exactly.

the monuments (Barclay and Case 2007, figs 10.1–3; Smith and Darvill 1990, fig. 156) give way to plain vessels of different forms placed with the burials (Barclay and Case 2007, figs 10.1–3; Smith and Darvill 1990, fig. 157:33) and, at Hazleton, to a Decorated vessel in a hearth on top of the primary fill in the south quarry (Smith and Darvill 1990, fig. 157:33). In the Haddenham long barrow, an open, light-rimmed pot with a rounded profile of Carinated Bowl

Table 14.11. Stone axeheads relating to radiocarbon dates shown in Figs 14.114–17 and 14.119–21.

Rock type	Site	Sub-division	Comments and references	Artefact type	Distribution
Continental or possibly continental					
Jadeitite	Sweet Track		Clarke *et al.* 1985, fig. 3.31		*Sweet Track*
Distinctive hard, grey Palaeozoic Sandstone, ?from Ardennes or Scandinavia	Kingsborough 2		M. Allen *et al.* 2008, 262, fig. 11: B	Axehead	GrA-29557, OxA-14791
Attributed to Group I by Vin Davis or, tentatively, to a source in northern France by Roger Taylor	Raddon		Axehead of unusual triangular outline (Gent and Quinnell 1999b, fig. 16:1; Quinnell and Taylor 1999)	Axehead	Between *start Raddon* and *end Raddon*
NW tuffs					
VI	Abingdon	Inner ditch section C-II layer 3	Avery 1982, 40	Axehead flake	*GrA-30923*, *C2 (4) 36*
VI	Briar Hill		Bamford 1985, fig. 46: S2–S5		Between *build Briar Hill* and *end Briar Hill ditches*
VI	Etton	Pits and phases 1B and 1C in ditch. Also other contexts post-dating primary use of site	Pryor 1998, 257–68	Axehead, axehead fragments, axehead flakes	Between start Etton and *end Etton*
VI	Haddenham enclosure	On a small mound built on the base of segment	Evans and Hodder 2006, 253–7, 352–3, figs 5.14, 5.15, 5.31	Axehead fragment	Between *start Haddenham* and *end Haddenham*
VI	Kilverstone	Pit 1472	Garrow *et al.* 2006, 71	Axehead fragments	*Beta-178142*
VI	Padholme Road, Fengate		Pryor 1974, 12	Axehead flake	*Gak-4197*
VI	Parnwell	Pit 2289	L. Webley 2007	2 Axehead flakes	*NZA-24076, -24077*
VI	Peak Camp	Area II	Darvill 1981; 1982a	Axehead flake	Between *start Peak Camp* and *end Peak Camp*
VI	Staines	Inner ditch	R. Robertson-Mackay 1987, 118	Axehead fragment	Between *start Staines* and *end Staines*
VI	Windmill Hill	Inner Ditch XI spit 3, at 2 ft–base	J. Pollard 1999a, 64; Pollard and Whittle 1999, 340	2 axehead flakes	Between *dig WH inner* and *end WH inner*
cf VI	Wellington Quarry	Pits 3853, 3855	Jackson and Miller forthcoming	Axehead fragments	*OxA-12547*, *OxA-12568* to *OxA-12570*
XI	Windmill Hill	Middle Ditch, IIb, spit 5, at 3.5–5 ft (nearly on base)	J. Pollard 1999a, 47; Pollard and Whittle 1999, 340	?Axehead flake	Between *dig WH middle* and *end WH middle*
SW greenstones					
I	Windmill Hill	Outer Ditch IIIA, spit 3, at 2–2.5 ft	J. Pollard 1999a, 30; Pollard and Whittle 1999, 340	4 Axehead fragments	Between *dig WH outer* and *end WH outer*
I	Hambledon	S long barrow, LB3, SIII, layer 26, phase I	I. Smith 2008b, 632	Fragment	*Hambledon S long barrow*
IV	Carn Brea	Site J, in ditch outside enclosure wall	I. Smith 1981: S3	Axehead fragment	Between *start Carn Brea* and *end Carn Brea*
IV	Hambledon	Main enclosure, segment 4, layer 5, phase VI	I. Smith 2008a, 632	Axehead flake	Between *build main enclosure* and *end main enclosure*
IVa	Hembury		It is difficult to match the sectioned implements to those mentioned in Liddell's reports. This exercise follows I. Smith's conclusion that 'groups IVa and XVII appear to be securely dated here' (1979, 17)		Between *start Hembury* and *end Hembury*

Rock type	Site	Sub-division	Comments and references	Artefact type	Distribution
IVa	Maiden Castle	AOR 2335 from context 283, part of 280, fill of 2235, phase 2A; AOR 1572 from 324, fill of 325, phase 2D	1 from inner ditch, 1 from outer.	Axeheads	From *start Maiden enclosure* to end *Maiden enclosure*
XVI	Carn Brea	Site A1, amongst tumble from wall; site A1, in F13; site D layer 1B	I. Smith 1981, 158–9	Axehead fragments and flakes	Between *start Carn Brea* and *end Carn Brea*
XVI	Hambledon	Pit B F14 in central area	I. Smith 2008b, 631	Axehead	*HAR-9167*
XVI	Hambledon	Main enclosure, segment 3, layer 4, phase VI	I. Smith 2008b, 632	Axehead fragment	Between *build main enclosure* and *end main enclosure*
XVII	Hazard Hill	Hearth 7; pit 5	Houlder 1963, 26	Axehead	BM-149, BM-150
XVII	Helman Tor	Surface of Neolithic occupation layer; F166	Roe 1997	Axehead fragments	Between *start Helman Tor* and *end Helman Tor*
XVII	Hembury		It is difficult to match the sectioned implements to those mentioned in Liddell's reports. This exercise follows I. Smith's conclusion that 'groups IVa and XVII appear to be securely dated here' (1979, 17)	Axehead fragments	Between *start Hembury* and *end Hembury*
cf XVII	Hambledon	Main enclosure, segment 10, layer 6B, phase VI	I. Smith 2008b, 632	Joining axehead fragments	*OxA-8850*
cf XVII	Hambledon	Stepleton enclosure, segment 23, ST1, interface of layers 2 and 3, probably phase V	I. Smith 2008b, 632		Between *build Stepleton enclosure* and *end Stepleton enclosure*
Altered Amphibolite	Hambledon	Main enclosure, segment 8, layer 7, phase III; segment 9, layer 8, phase III; segment 10, layer 4, phase V	I. Smith 2008b, 632	Fragments probably from same axehead	Between *build main enclosure* and *end main enclosure*
Altered gabbro	Hambledon	S long barrow, LB3, SIII, layer 40, phase I; LB3, SIII, layer 21, phase III	I. Smith 2008b, 632	Flake and fragment, probably from same axe	*build long barrow*
Ungrouped greenstones	Carn Brea	Several contexts	I. Smith 1981, 159	Axehead fragments	Between *start Carn Brea* and *end Carn Brea*
Ungrouped greenstones	High Peak	Neo levels in trenches A and GA	S. Pollard 1966, 51	Axehead fragments	*BM-214*
Wales or Midlands?					
Banded tuff	Hambledon	Main enclosure, segment 7, layer 4, phase VI	I. Smith 2008b, 632	Axehead fragment	between *build main enclosure* and *end main enclosure*
N Wales					
VII	Etton	Pit F857	The only group VII even possibly from phase 1 (Pryor 1998, 264)	Axehead fragment	between *start Etton* and *end Etton*
S Wales					
VIII	Hambledon	Outer E cross-dyke, segment 5, layer 4, phase VI	I. Smith 2008b, 632	Axehead flake	Between *start Hambledon* and *end Hambledon*
cf VIII	Carn Brea	Site K, occupation surface at base of layer 2	I. Smith 1981, 159	Axehead fragment	Between *start Carn Brea* and *end Carn Brea*

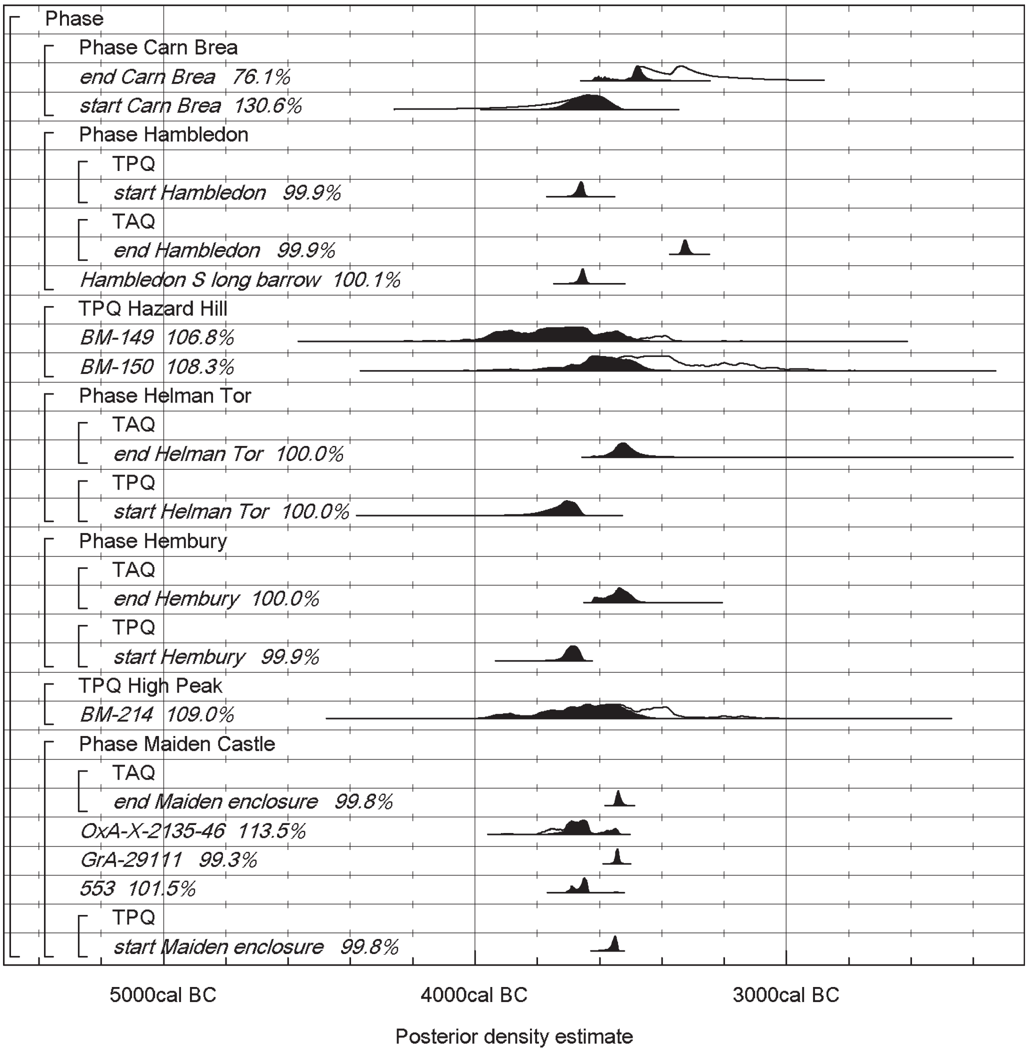


Fig. 14.105. Probability distributions of dates for gabbroic pottery fabrics in southern Britain. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Figs 4.7–13 (Hambledon Hill), Figs 4.41–5 (Maiden Castle), Figs 10.9–12 (Hembury), Fig. 10.22 (Helman Tor) and Fig. 10.25 (Carn Brea). The overall structure of this model is shown in Fig. 14.104, and its other component in Fig. 14.106.

affinities but with internal fluting (Knight 2006a, fig. 3.58: P1), placed close to a postpipe of the façade, was succeeded by sherds of a closed, heavy-rimmed, shouldered, Mildenhall style Decorated vessel (Knight 2006a, fig. 3.58: P2) outside the blocking of the main chamber. At Orton Meadows, Carinated Bowls in the first burial alignment were succeeded by heavier-rimmed bowls with fluting on the rim tops and the interior of the necks (Mackreth forthcoming). In the two Hambledon enclosure ditches, the frequency of decoration increased from bottom to top (I. Smith 2008a, table 9.11).

Given that Chalk Hill is among the earlier causewayed enclosures (Fig. 14.5), the Carinated Bowl element, seen as redeposited by Gibson and Leivers (2008, 252), might perhaps have been an integral part of the assemblage. At the other end of the timescale, the demonstration that Ebbsfleet Ware found near the base of the outer ditch at Windmill Hill in fact came from a later fourth or early third millennium cal BC recut (Chapter 3) removes the foundation of an argument that this tradition developed significantly earlier than the more elaborate varieties of Peterborough Ware (I. Smith 1966a, 474–8) and overlapped substantially with Decorated Bowl. The results of a Peterborough Ware dating programme undertaken by Peter Marshall, Ann Woodward and others are still pending (2011). In the meantime, it can be noted that the Welsh Peterborough Ware dates shown in Fig. 11.9 include a *terminus post quem* of *3340–2920 cal BC* (*95% probability*), probably of *3330–3215 cal BC* (*28% probability*) or *3180–3155 cal BC* (*4% probability*) or *3125–3010 cal BC* (*31% probability*) or *2980–2960 cal BC* (*4% probability*) or *2950–2940 cal BC* (*1% probability*), for a vessel of Ebbsfleet form accompanying a burial at Four Crosses, Powys (Table 11.4: *CAR-670*); and that the Etton dates include a measurement of *3350–3210 cal BC* (*95% probability*), probably of *3330–3275 cal BC* (*55% probability*) or *3265–3250 cal BC* (*13% probability*), on carbonised residue from an Ebbsfleet Ware sherd (Fig. 6.33; Table 6.8: *GrA-29353*).

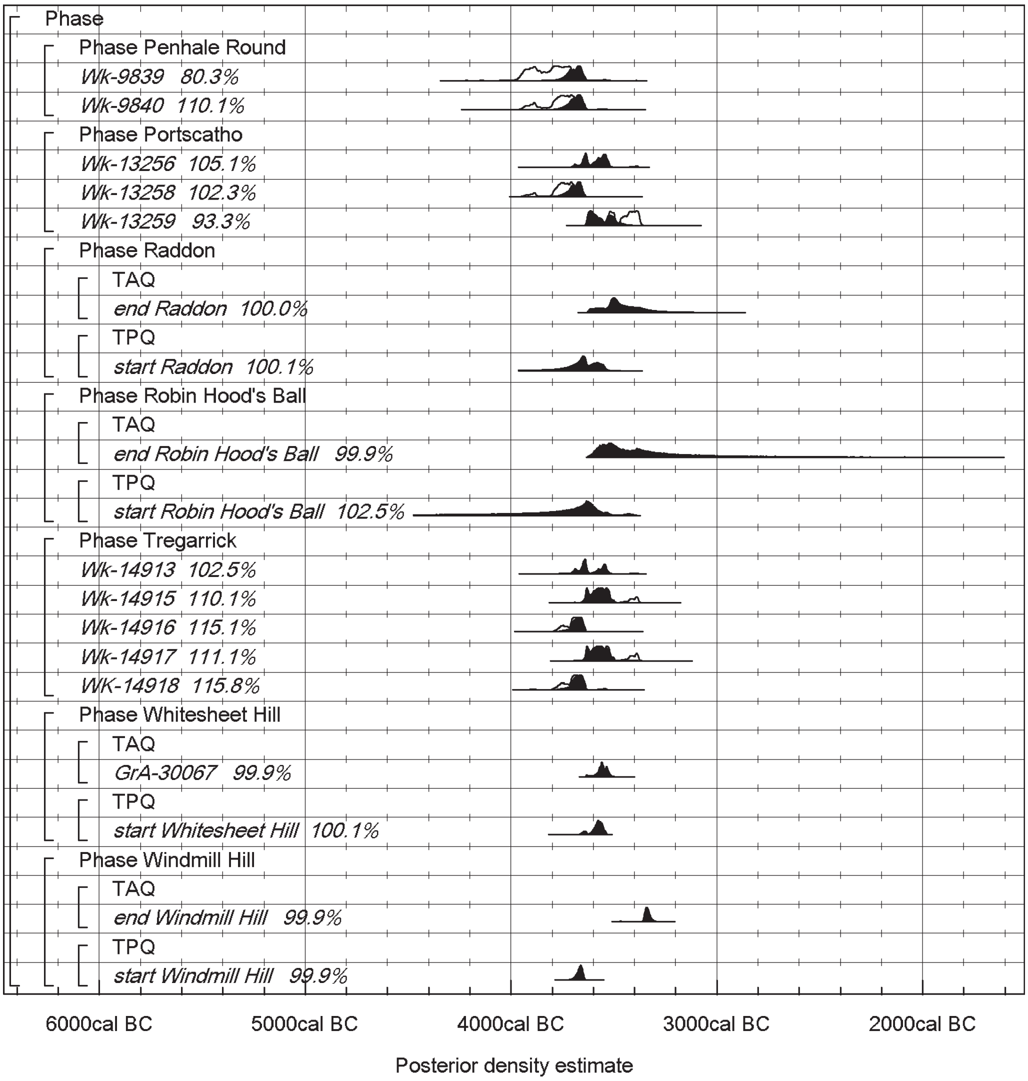


Fig. 14.106. Probability distributions of dates for gabbroic pottery fabrics in southern Britain. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Figs 3.8–11 (Windmill Hill), Fig. 4.26 (Whitesheet Hill), Fig. 4.51 (Robin Hood's Ball) and Fig. 10.16 (Raddon). The overall structure of this model is shown in Fig. 14.104, and its other component in Fig. 14.105.

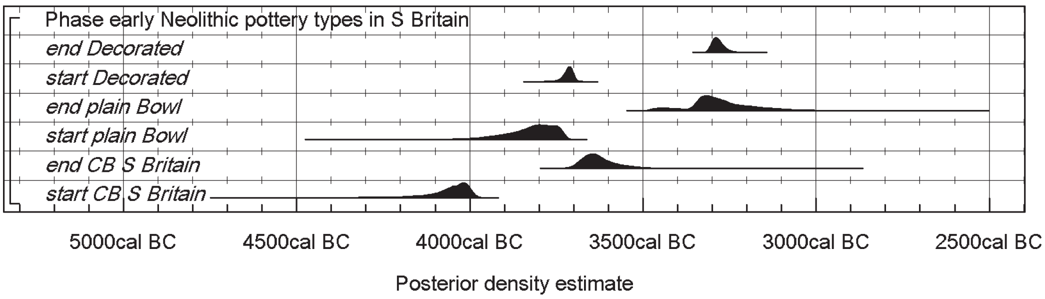


Fig. 14.107. Probability distributions for the currency of early Neolithic pottery types in southern Britain, derived from the models shown in Figs 14.88, 14.90 and 14.92 (and its component parts).

Axeheads

Stone axeheads, like gabbroic pottery fabrics, were recognised in the inter-war period as non-local imports at causewayed enclosures: artefacts brought from upland and mountainous areas to lowland England. The subsequent history of the identification of the implements and their sources is summarised, from different perspectives, by Grimes (1979) and Bradley and Edmonds (1993, 43–58). Many of the rocks in question have been assigned to petrological groups of varying homogeneity and validity (I –XXIV, listed by Clough, 1988, table 3). In general terms they range between two main kinds: fine-grained rocks that

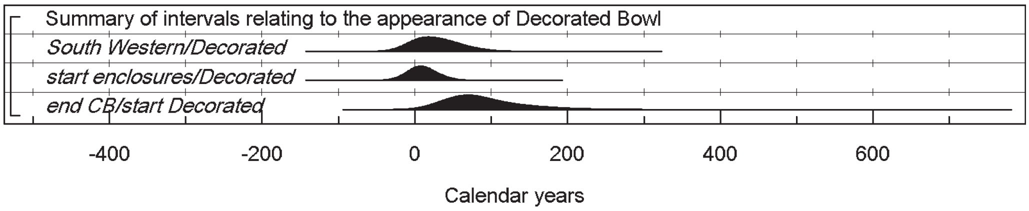


Fig. 14.108. Intervals between the end of the Carinated Bowl tradition and the appearance of Decorated Bowl, and between this and the appearance of causewayed enclosures and South-Western style pottery in southern Britain, derived from parameters calculated by the models shown in Figs 14.88, 14.1–4, 14.92 (and its component parts) and 14.101–3.

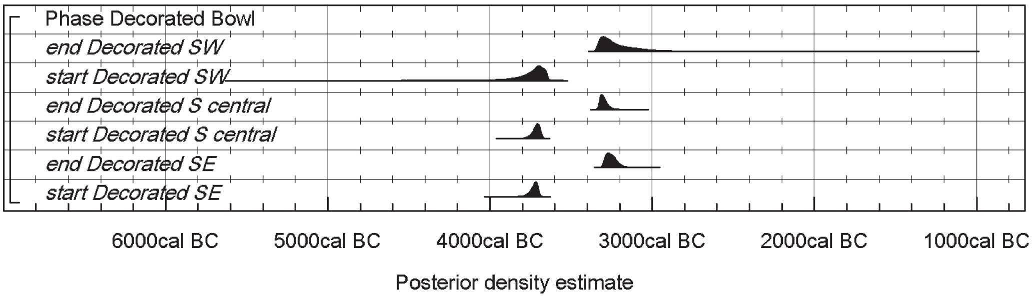


Fig. 14.109. Probability distributions for the currency of Decorated Bowl in different areas of southern Britain, derived from the models shown in Figs 14.93–5, 14.96–8 and 14.99.

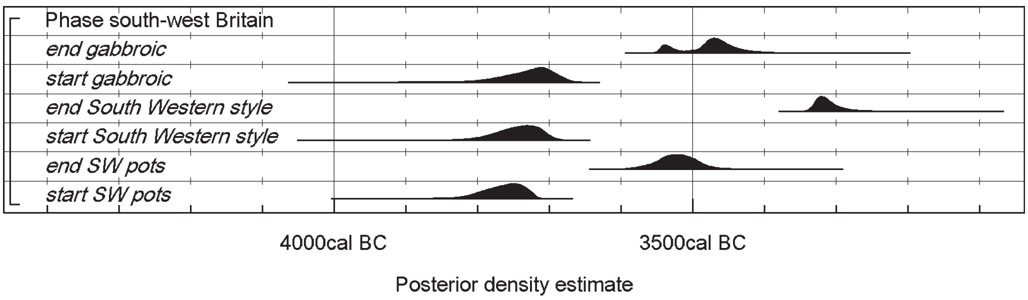


Fig. 14.110. Probability distributions for the currency of Bowl pottery, South-Western style pottery, and early Neolithic gabbroic fabrics in south-west Britain, derived from the models shown in Figs 14.77–9, 14.101–3 and 14.104–6.

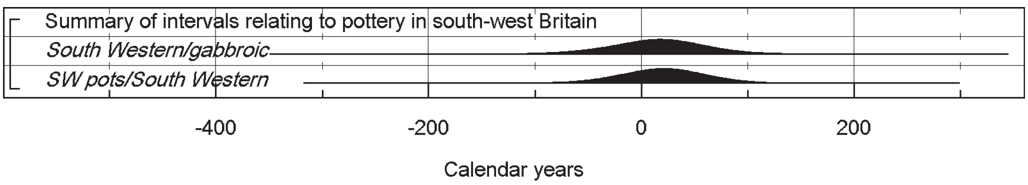


Fig. 14.111. Intervals between the first pottery in south-west Britain and the start of the South-Western style, and between this and the introduction of gabbroic fabrics in this tradition, derived from parameters calculated by the models shown in Figs 14.77–9, 14.101–3, and 14.104–6.

can be knapped like flint and coarser-grained rocks worked primarily by pecking and hammering. Of course, in reality, both methods of manufacture were used across a range of rock fabrics and textures. Extraction and working sites for the former are more readily identifiable by their relatively abundant debitage, as at Great Langdale in Cumbria, Graig Lwyd in Gwynedd, or Tievebulliagh and Rathlin Island in Co. Antrim. Comparable sites for the latter, many of which derive from the south-west peninsula, are elusive. This may be partly due to the lack of distinctive working debris; it is increasingly probable, however, that, at least in the case of the numerous implements attributed to petrologically diverse altered epidiorite rocks (Groups I, II, III, IV, XVI and XVII) that the main raw materials may have been collected as cobbles from beaches and perhaps other secondary deposits in Cornwall (P. Berridge 1993). Glacial erratics were also employed, both opportunistically and systematically, as in the case of Group VIII, where

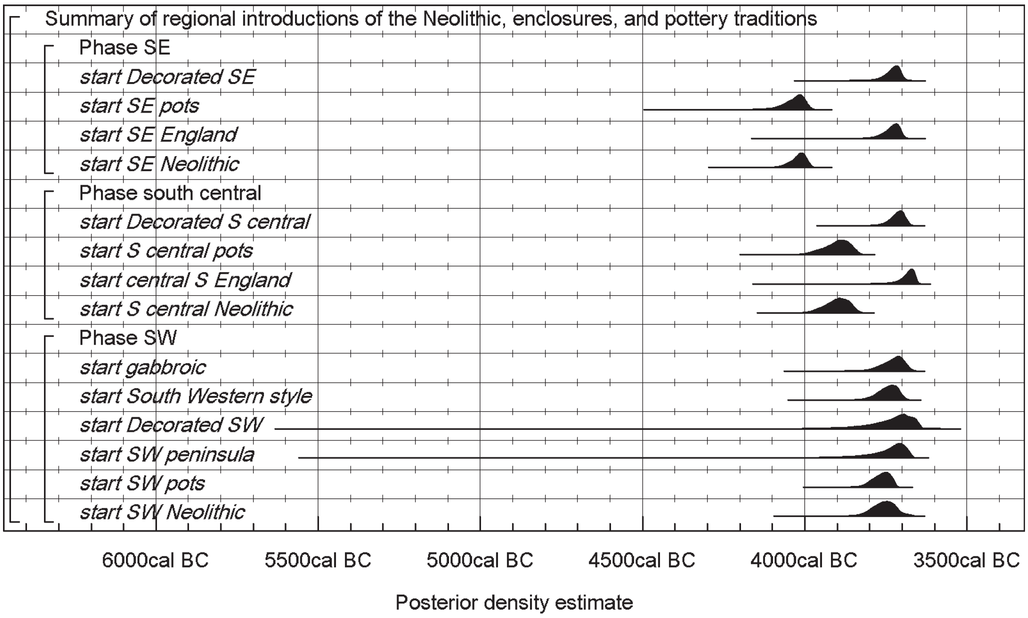


Fig. 14.112. Probability distributions of dates for the introduction of the earliest Neolithic things and practices (start SE Neolithic, start S central Neolithic, start SW Neolithic), causewayed or stone-walled tor enclosures (start SE England, start central S England, start SW peninsula), Bowl pottery (start SE pots, start S central pots, start SW pots), and Decorated Bowl pottery (start Decorated SE, start Decorated S central, start Decorated SW) in different areas of southern Britain, and of the South-Western style (start South Western style) and gabbroic fabrics (start gabbroic), derived from the models defined in Figs 14.57, 14.18, 14.68, 14.72, 14.77, 14.93, 14.96, 14.99, 14.101, and 14.104 (and their component parts if appropriate).

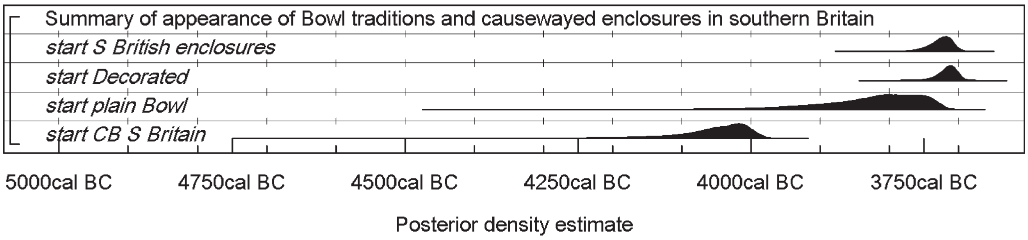


Fig. 14.113. Probability distributions of dates for the introduction of the different Bowl traditions and causewayed or related enclosures in southern Britain, derived from the models defined in Figs 14.1–4, 14.92 (and its component parts), 14.90 and 14.88.

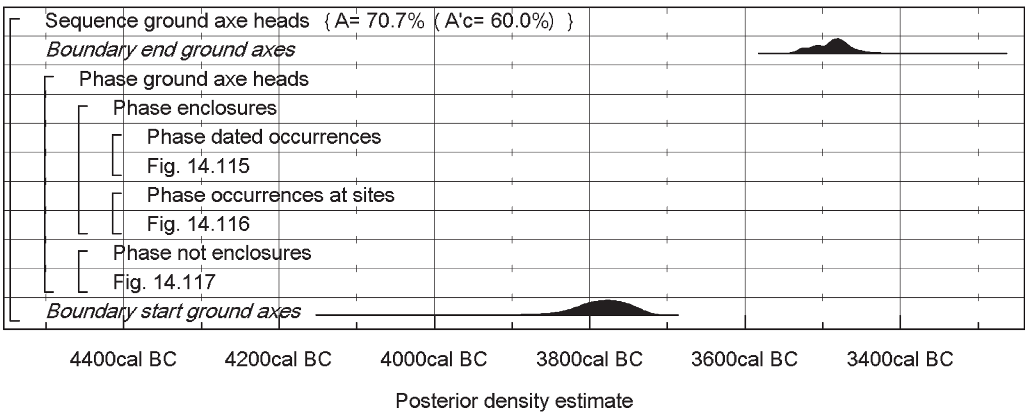


Fig. 14.114. Overall structure of the chronological model for the currency of early Neolithic ground axeheads of stone and distinctive flints in early Neolithic contexts in southern Britain. The component sections of this model are shown in detail in Figs 14.115–17. The large square brackets down the left-hand side of Figs 14.114–17, along with the OxCal keywords, define the overall model exactly.

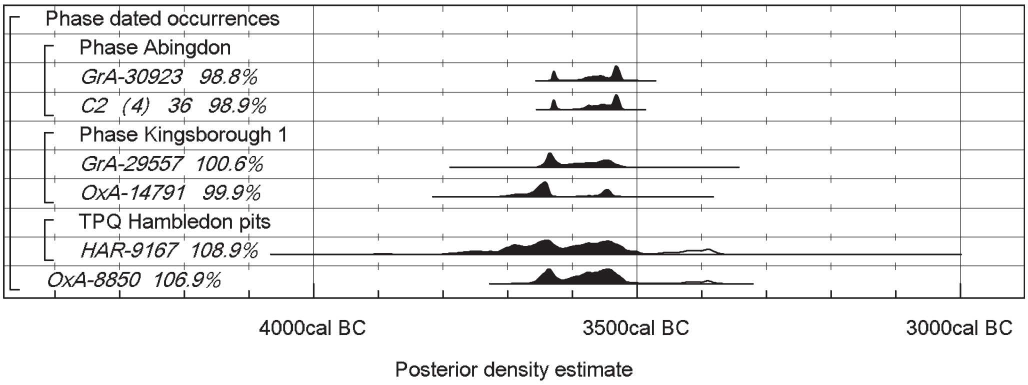


Fig. 14.115. Probability distributions of dates from enclosures directly associated with ground axeheads of stone and distinctive flints in early Neolithic contexts. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Figs 4.7–13 (Hambledon Hill), Figs 7.15 (Kingsborough 1), and Figs 8.18–21 (Abingdon). The overall structure of this model is shown in Fig. 14.114, and its other components in Figs 14.116–17.

erratic sources have been identified in Pembrokeshire (David and Williams 1995). While some of these sources were used locally by hunter-gatherer populations, their Neolithic use is marked by transport away from those sources, sometimes over substantial distances. Many petrological groups consist of relatively few implements. At the other end of the scale, Group VI axeheads, from the Great Langdale areas of central Cumbria, are by far the most numerous and have been found throughout northern, central and eastern Britain with scarcer examples in other areas (Clough and Cummins 1988, map 6). The next most numerous is Group I, which is concentrated south of the Trent-Severn line (Clough and Cummins 1988, map 2). There are also a small number of implements certainly or probably from continental sources, described below.

Neolithic flint axeheads, whether ground or flaked, are of forms distinct from Mesolithic ones and were made from a wide variety of flints, from both superficial and mined sources. Flint sourcing has progressed far enough to indicate that axeheads from the Sussex flint mines were transported into other regions (Craddock *et al.* 1983; forthcoming). Some flint axeheads stand out because they are made of material distinct from that of the rest of the industries in which they occur and distinct from the dark-coloured products of known flint mines. Depending on local circumstance, these may reflect careful selection of materials from nearby sources or transport over shorter or longer distances. Uneven levels of reporting mean that they will not always have been noted in publications. Where such distinctive flint axeheads can be pinpointed in the literature they are included in the models shown in Figs 14.114–18.

The vast majority of Neolithic stone and flint axeheads are stray finds, and only a fraction of the stratified samples are effectively dated. It is clear, too, that both continued to be made and used into at least the third millennium cal BC. Fiona Roe's list of over 20 stone axeheads, including those from north-western, south-western and Welsh sources, with Grooved Ware associations (1999, table 7.22) makes this point effectively. The use of a particular facies of the Langdale rock for Beaker period bracers (A. Woodward *et al.* 2006) suggests continued or resumed exploitation of this particular source into the late third or early second millennium cal. BC. The models shown in Figs 14.114–17, 14.118, 14.119–21, 14.122, 14.124–6, 14.127, 14.128, and 14.134–6 therefore include only artefacts stratified in early Neolithic contexts, these being listed in Tables 14.11 and 14.13. This is counter to Isobel Smith's assumption 'that surface finds probably relate to the main period of activity on the site in question' in her classic paper on stone axehead chronology (1979, 13), and it excludes many axeheads from superficial contexts on enclosures, some of which are probably of early Neolithic date. It is, however, the only secure way to proceed, given circumstances like those of Etton, where almost half of stone axehead finds post-date the primary use of the enclosure (phase 1) and there is a Peterborough Ware and Grooved Ware presence (Pryor 1998, 195–204, 262–3). At Carn Brea (Chapter 10) only those from the eastern summit enclosure are securely dated without question, and that from rampart 5 on site A3 is excluded, along with several unstratified examples from the site (see Chapter 10.5). Implements of south-western Groups IV, XVI and XVII and Welsh Group XIII from Wheeler's excavations at Maiden Castle, some of them from early Neolithic contexts, are reluctantly excluded because it is not possible from published sources to relate the petrological identifications to the implements described in the 1943 publication and hence to determine which were in early Neolithic contexts.

On this basis, a model for the currency of ground stone axeheads and distinctive flint axeheads from early Neolithic contexts in southern Britain is shown in Figs 14.114–17. Figure 14.115 shows the few measurements directly associated with the artefacts in enclosures. Figure 14.116 shows the more numerous instances where *termini post* and *ante quos* are provided for implements by start and end dates for individual earthworks or entire enclosures. Figure 14.117 shows dates of both kinds for implements from non-enclosure contexts. This suggests that the first example was deposited in *3850–3720 cal BC* (*95% probability*;

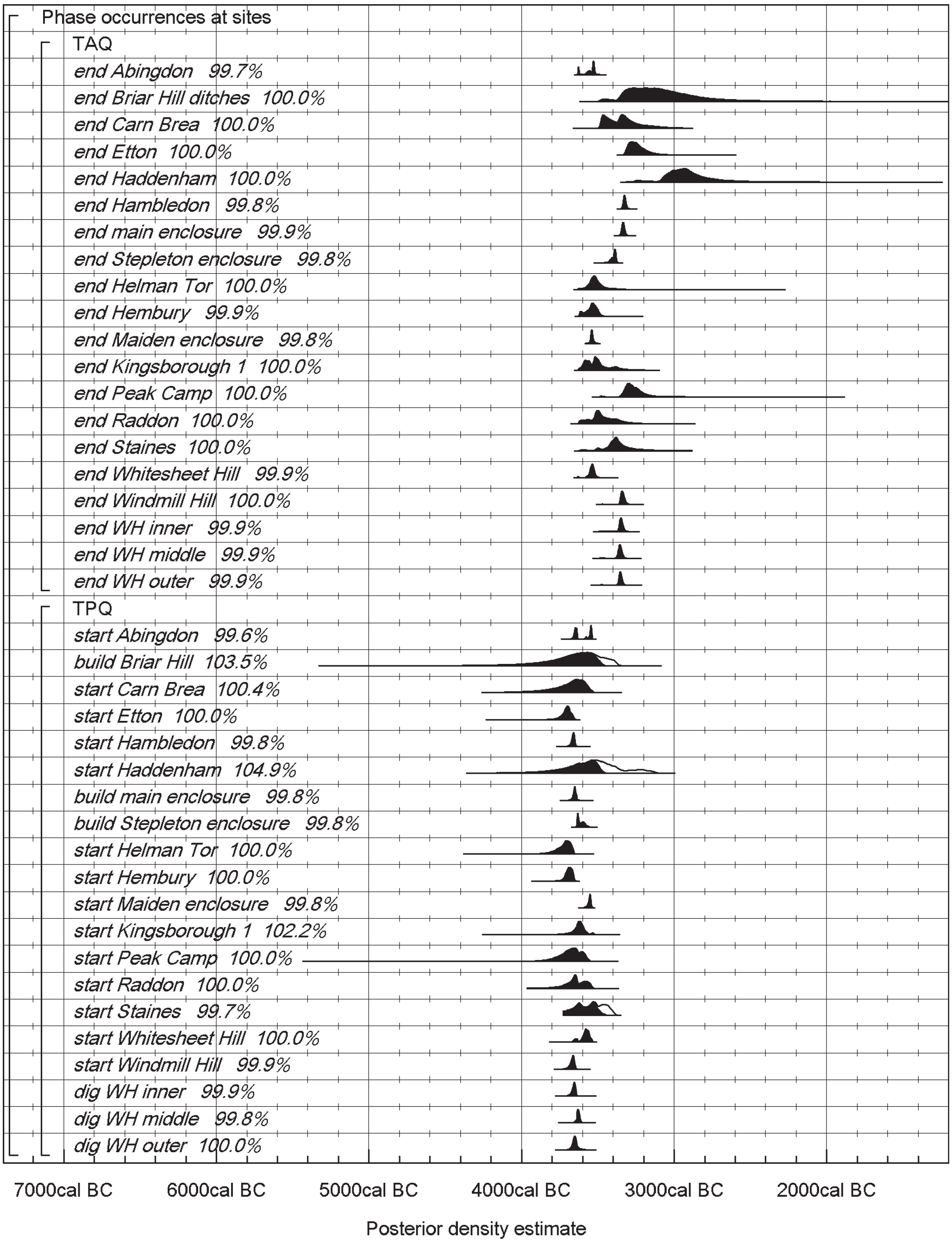


Fig. 14.116. Probability distributions of dates from enclosure sites with ground axeheads of stone and distinctive flints in early Neolithic contexts. The format is identical to that for Fig. 14.1. Distributions have been taken from the models listed in the captions to Figs 4.2–4. The overall structure of this model is shown in Fig. 14.114, and its other components in Figs 14.115 and 14.117.

Fig. 14.114: *start ground axes*), probably in *3810–3745 cal BC* (*68% probability*). In early Neolithic contexts in southern Britain, the practice ended in *3540–3440 cal BC* (*95% probability*; Fig. 14.114: *end ground axes*), probably in *3515–3460 cal BC* (*68% probability*).

Figure 14.118 shows a model for the chronology of the use of distinctive flints for polished axeheads in southern Britain. This material may have come from numerous sources, but there seems to have been a widespread preference for a creamy white to pale grey colour with inclusions which provide a marbled effect when polished. This obtains regardless of location. At Abingdon, on the upper Thames, 'creamy material with cherty inclusions' was used for polished axeheads (Avery 1982, 35); at Kingsborough 1, on Sheppey, a complete axehead is of 'light grey flint that has probably derived from a different source' (Butler and Leivers 2008, 257); a butt fragment from the Fir Tree Field shaft in Dorset is of 'an off-white coarse-grained cherty ?flint with traces of fossil inclusions which is likely to have been imported' (M. Green 2007c,

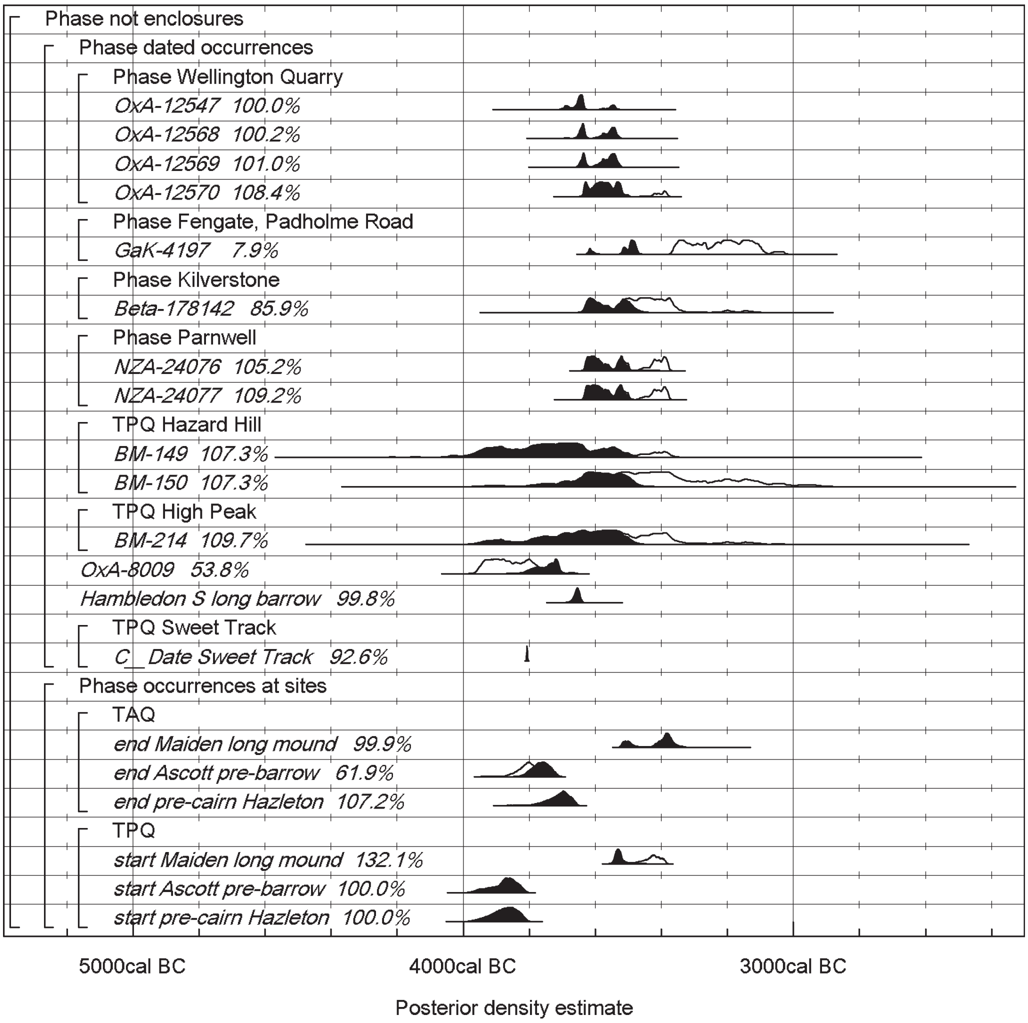


Fig. 14.117. Probability distributions of dates directly associated with ground axeheads of stone and distinctive flints in early Neolithic contexts, and from other sites where such axeheads have been found. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Figs 4.7–13 (Hambledon Hill), Fig. 4.21 (Fir Tree Field shaft) and Figs 4.41–5 (Maiden Castle), and from the models defined by Meadows et al. *(2007, figs 6–9) (Hazleton) and Bayliss* et al. *(2007c, figs 3 and 5–7) (Ascott-under-Wychwood). The overall structure of this model is shown in Fig. 14.114, and its other components in Figs 14.115–16.*

283); and at Hembury, in Devon, there is an 'opaque grey or white "Lincoln Flint" which is used exclusively for axes on this site and most of the pieces are burnt' (Liddell 1932, 178) It should be noted that while such flint can be found in Lincolnshire, it also occurs in superficial deposits elsewhere (e.g. Healy 1988, 33). These axeheads made of distinctive flint first appear in *4130–3755 cal BC* (*95% probability*; Fig. 14.118: *start different flint*), probably in *3940–3790 cal BC* (*68% probability*). They ceased to be deposited in early Neolithic contexts in southern Britain in *3575–3365 cal BC* (*95% probability*; Fig. 14.118: *end different flint*), probably in *3555–3480 cal BC* (*68% probability*).

A chronological model for the overall currency of ground stone axeheads from English and Welsh sources in early Neolithic contexts in southern Britain is given in Figs 14.119–21. Figure 41.120 shows measurements directly associated with implements from enclosures followed by *termini post* and *ante quos*. Figure 14.121 does the same for non-enclosure contexts. This model suggests that they first appeared in *3785–3650 cal BC* (*95% probability*; Fig. 14.119: *start stone axes*), probably in *3735–3710 cal BC* (*20% probability*) or *3700–3660 cal BC* (*48% probability*). In early Neolithic contexts in southern Britain, their deposition ceased in *3540–3440 cal BC* (*95% probability*; Fig. 14.119: *end stone axes*), probably in *3530–3520 cal BC* (*1% probability*) or *3515–3465 cal BC* (*67% probability*).

The main source areas of dated stone axeheads from southern Britain fall into three broad geographical zones: a north-western one comprising Great Langdale and adjacent deposits (Groups VI and XI), a south-western one comprising primarily Cornish sources (Groups I, IV, IVa, XVI, XVII and ungrouped greenstones), and a smaller Welsh one (Groups VII and VIII). They are examined separately in Figs 14.122, 14.124–6, and 14.127.

A chronological model for the currency of ground stone

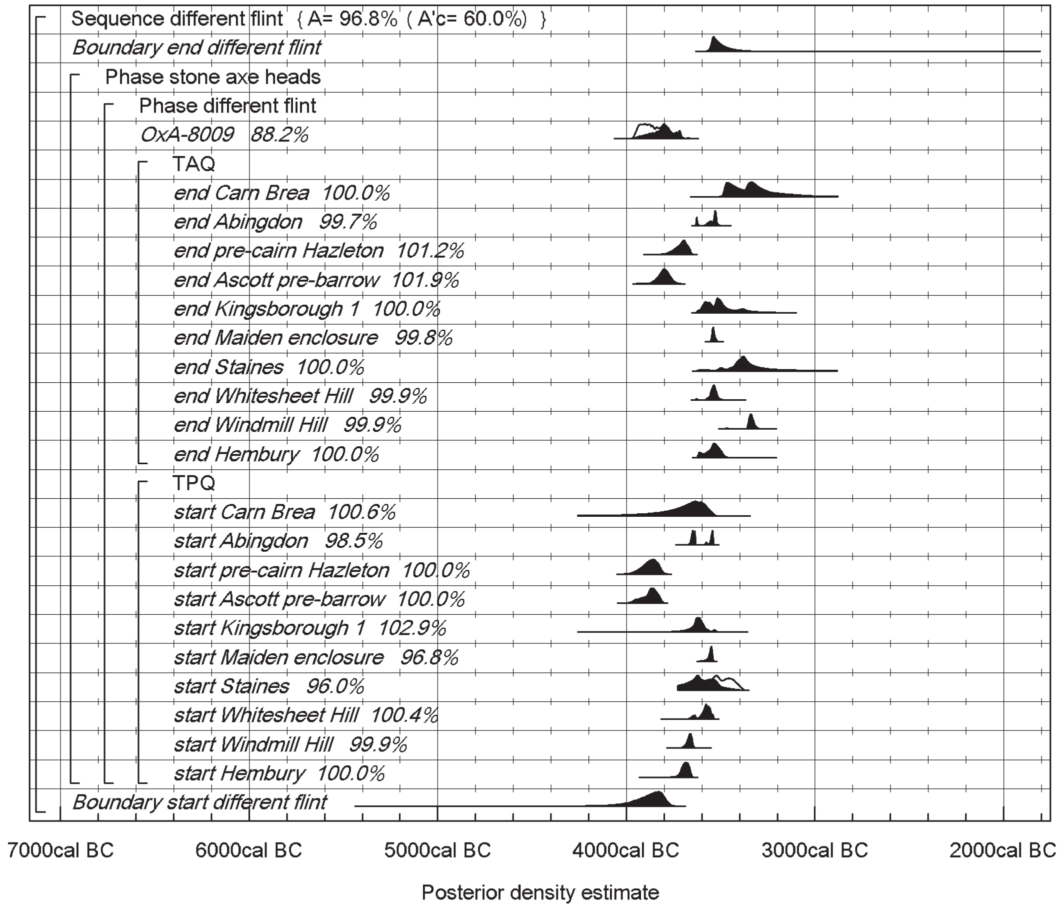


Fig. 14.118. Probability distributions of dates associated with ground flint axeheads made from distinctive flint in southern Britain. The format is the same as for Fig. 14.1. Distributions for enclosures have been taken from the models listed in the captions to Figs 4.2–4; other distributions have been taken from models defined in Fig. 4.21 (Fir Tree Field shaft), and by Meadows et al. *(2007, figs 6–9) (Hazleton) and Bayliss* et al. *(2007c, figs 3 and 5–7) (Ascott-under-Wychwood). The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the model exactly.*

axeheads from north-western sources in early Neolithic contexts in southern Britain is shown in Fig. 14.122. This model suggests that they began to be deposited there in *3705–3540 cal BC* (*95% probability*; Fig. 14.122: *start NW axes*), probably in *3670–3630 cal BC* (*29% probability*) or *3610–3555 cal BC* (*39% probability*). In early Neolithic contexts in southern Britain, their deposition ceased in *3535–3370 cal BC* (*92% probability*; Fig. 14.122: *end NW axes*) or *3365–3315 cal BC* (*3% probability*), probably in *3510–3445 cal BC* (*68% probability*). It must be remembered that all the finds concerned are well removed from the source area, so that earlier associations may occur in the north of England. This southern currency is, however, consistent with the limited dating for the working of the Langdale outcrops (Fig. 14.123; Table 14.12). Those limitations are plural. Given the extent of the outcrop and its exploitation (Claris and Quartermaine 1989, fig. 2), the dates are thinly spread. Where samples are specified they were all bulk charcoal of several taxa and thus capable of including material of various ages, although centuries-old trees are unlikely to have grown on the mountain. They are therefore all interpreted as *termini post quos.*

The dated south-western implements include examples from the source area, and the slightly earlier date estimate for the start of the exploitation of these rocks may well reflect this. A chronological model for the currency in early Neolithic contexts from southern Britain of ground stone axeheads from sources in south-west England is shown in Figs 14.124–6. This model suggests that the exploitation of these sources began in *3810–3635 cal BC* (*86% probability*; Fig. 14.124: *start SW axes*) or *3615–3540 cal BC* (*9% probability*), probably in *3710–3645 cal BC* (*68% probability*). The deposition of axeheads from these sources in early Neolithic contexts in southern Britain ceased in *3555–3470 cal BC* (*95% probability*; Fig. 14.124: *end SW axes*), probably in *3540–3510 cal BC* (*68% probability*).

A chronological model for the currency in early Neolithic contexts from southern Britain of the three stratified and dated stone axeheads from sources in Wales is shown in Fig. 14.127. Unfortunately the small number of artefacts renders this of limited utility. It does suggest, however, that the Welsh sources were also exploited by the mid-fourth millennium cal BC, on the evidence of dates for Etton for Group VII and for Hambledon and Carn Brea for Group VIII and cf Group VIII respectively. Recent investigations on Graig Lwyd have yielded two dates which seem to relate

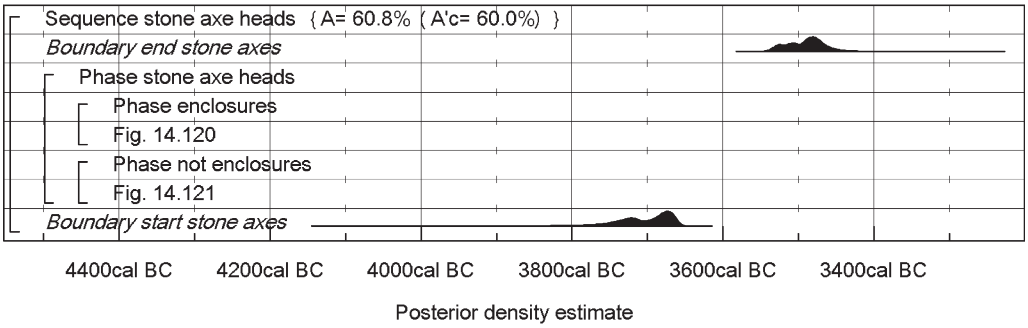


Fig. 14.119. Overall structure of the chronological model for the currency of early Neolithic ground stone axeheads in southern Britain. The component sections of this model are shown in detail in Figs 14.120–1. The large square brackets down the left-hand side of the figures, along with the OxCal keywords, define the overall model exactly.

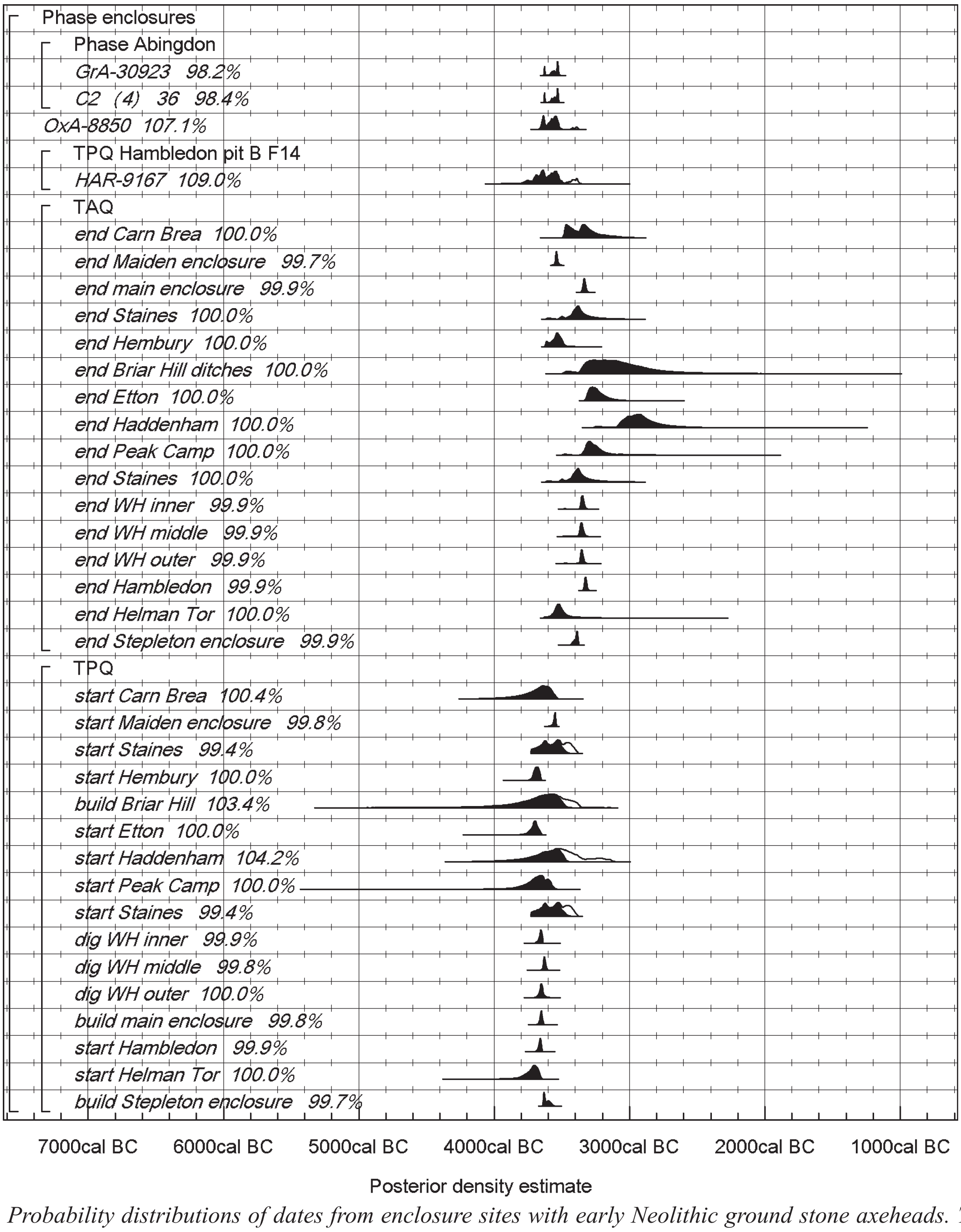


Fig. 14.120. Probability distributions of dates from enclosure sites with early Neolithic ground stone axeheads. The format is identical to that for Fig. 14.1. Distributions have been taken from the models listed in the captions to Figs 4.2–4. The overall structure of this model is shown in Fig. 14.119, and its other component in Fig. 14.121.

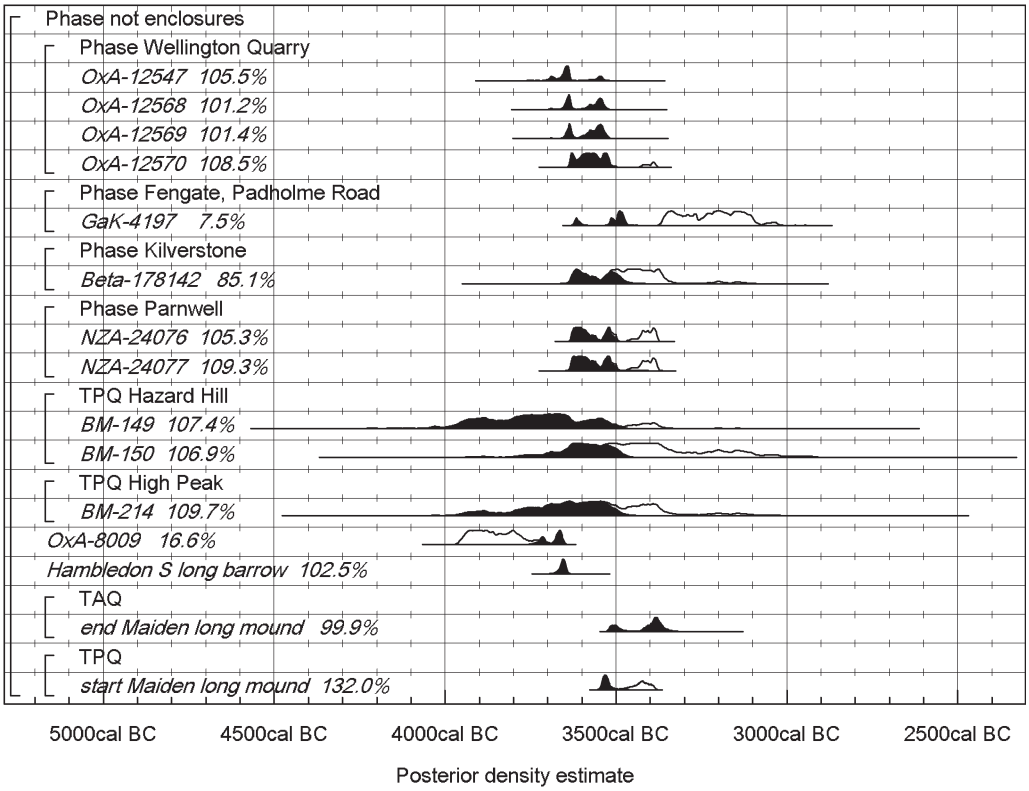


Fig. 14.121. Probability distributions of dates directly associated with early Neolithic ground stone axeheads, and from other sites where such axeheads have been found. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Figs 4.7–13 (Hambledon Hill), Fig. 4.21 (Fir Tree Field shaft) and Figs 4.41–5 (Maiden Castle). The overall structure of this model is shown in Fig. 14.119, and its other component in Fig. 14.120.

to extraction and working there (Table 14.12: Beta-128505, SWAN-1420; Williams and Davidson 1998). These too are *termini post quos*, and the more recent of them may relate to the late Neolithic exploitation evidenced by a Graig Lwyd axehead fragment and flakes in a third millennium cal BC pit within henge B at Llandygai, some 15 km away (Lynch and Musson 2001, 69–71, 120). Earlier local use is shown by evidence for working of the material at an early Neolithic house recently discovered at Parc Bryn Cegin, immediately next to Llandygai (Kenney and Davidson 2006; Kenney 2009).

The only indubitable continental import to be found in a dated context is an axehead of Alpine jadeitite from beside the Sweet Track in the Somerset Levels, for which the dendrochronological construction date for the track provides a *terminus post quem*, on the assumption that the track would have been there before the artefact could have been deposited from it (Fig. 14.128: *Sweet Track*). This artefact may already have been an heirloom when deposited, since quarrying at the source seems to have ceased by the end of the fifth millennium cal BC (Pétrequin *et al.* 2008, 269). If so, the same applies to the other jadeitite artefacts from Britain, including unstratified finds from the main enclosure on Hambledon Hill and from the possible enclosure at High Peak, Devon (I. Smith 2008b, 630). The Sweet Track date is shown with dates relating to two possibly continental imports: a fragmentary axehead of hard, grey Palaeozoic sandstone, perhaps from the Ardennes or Scandinavia, placed over a small group of animal bones in a segment butt at Kingsborough 2 (M. Allen *et al.* 2008, 244–5, 262) and a complete axehead from near the base of the outer ditch at Raddon which is variously attributed to Group I or, tentatively, to a source in northern France (Quinnell and Taylor 1999). Whatever its source, the fan-shaped outline of the implement, which has a pointed butt and a very wide blade, is exceptional (Gent and Quinnell 1999b, fig. 16:1). This and its green colour suggest an attempt to replicate a jadeitite axehead, some of which are of similar outline (Pétrequin *et al.* 2008, fig. 22.2). It is described as 'soft', in other words non-functional.

Jadeitite axeheads also reached Ireland, as did Group VI axeheads from Langdale, one example being found at Ballygalley, Co. Antrim, although not in a definitely early Neolithic context. Some ungrouped gabbros from Ireland may also be of British origin (Cooney and Mandal 1998, 105–10, 175–6). Antrim porcellanite axeheads were brought into Britain (Sheridan *et al.* 1992, fig. 6), as was Antrim flint and axeheads made of it (Saville 1999a). Neither is known from a stratified early Neolithic context, although there is a surface find of a flake from a porcellanite axehead from the same field as the Hazard Hill site in Devon (Clough and Cummins 1988, 161).

The Sweet Track provides a *terminus post quem* not only for the jadeitite axehead but for a flint one found beside it

Table 14.12. Radiocarbon dates from Great Langdale and Graig Lwyd.

Site	Laboratory number	Material	Context	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)
Langdale						
Langdale	BM-281	Unidentified bulk charcoal sample	Associated with implements and chippings, 90 cm below surface of peat	4680±135		3710–3020
Thunacar Knott	BM-676	Unidentified bulk charcoal sample	From layer of axe chippings (Bradley and Edmonds 1993, 80–81; Clough 1973)	4474±52		3360–2920
Stake Beck	OxA-2181	*Corylus avellana*, Pomoideae, *Quercus* and *Salix/Populus* charcoal. *Quercus* 20–75 years-old, remainder young wood	Surface of working floor, ?formed of dumps of material, seen as providing TAQ for site (Bradley and Edmonds 1993, 112–15)	4790±80	−25.5	3710–3360
Harrison Stickle trench 1	BM-2625	*Betula*, Pomoideae, *Quercus* and *Salix/Populus* charcoal. *Quercus* 20–75 years-old (mainly 20–35), remainder 3–25 yr	Associated with deposit of *in situ* debitage (Bradley and Edmonds 1993, 115–17)	4870±50	−25.3	3760–3530
Harrison Stickle trench 4	BM-2626	*Betula*, Pomoideae, *Corylus avellana*, and *Salix/Populus* charcoal, all 3–25 years-old	Associated with accumulation of debitage in natural hollow (Bradley and Edmonds 1993, 117–18)	4880±50	−24.8	4350–3960
Top Buttress site 95	BM-2628	*Betula*, Pomoideae, *Quercus* and *Salix/Populus* charcoal. *Betula* 3–25 yr, *Salix/Populus* 3–25 yr, *Quercus* 20–75 yr (mainly 20–35 yr)	1.30–1.40 m from surface, at base of sequence of *in situ* and dumped knapping deposits, stratified below BM-2627 (Bradley and Edmonds 1993, 126–9, fig. 6.13)	4760±50	−23.5	3650–3370
Top Buttress site 95	BM-2627	*Betula*, Pomoideae, *Quercus* and *Salix/Populus* charcoal. *Quercus* 20–75 yr (mainly 20–35 yr), *Betula* 3–75 yr (mainly 20–35 yr), *Salix/Populus* 3–25 yr, *Corylus avellana* 3–75 yr	0.40–0.50 cm from surface, near top of sequence of *in situ* and dumped knapping deposits, stratified above BM-2628 (Bradley and Edmonds 1993, 126–9, fig. 6.13)	6965±30		5980–5740
Thorn Crag	OxA-4212	Unspecified charcoal	Under flake-filled deposit	5080±90	−25.6	4050–3650
Graig Lwyd						
Site B, Trench 6, context 625/617	Beta-128505	Unspecified charcoal	Layer including Graig Lwyd flakes, from minimal exposure of deposits which 'may represent the stone scree layer exoloited for axe-making material' (Williams and Davidson 1998, 11–12)	4400±40		3310–2900
Cairn 67	SWAN-142	Unspecified charcoal flecks and lumps	From among tightly packed fresh, sharp Graig Lwyd flakes in clay sealed beneath a cairn (Williams and Davidson 1998, 18–19)	5330±90		4350–3960

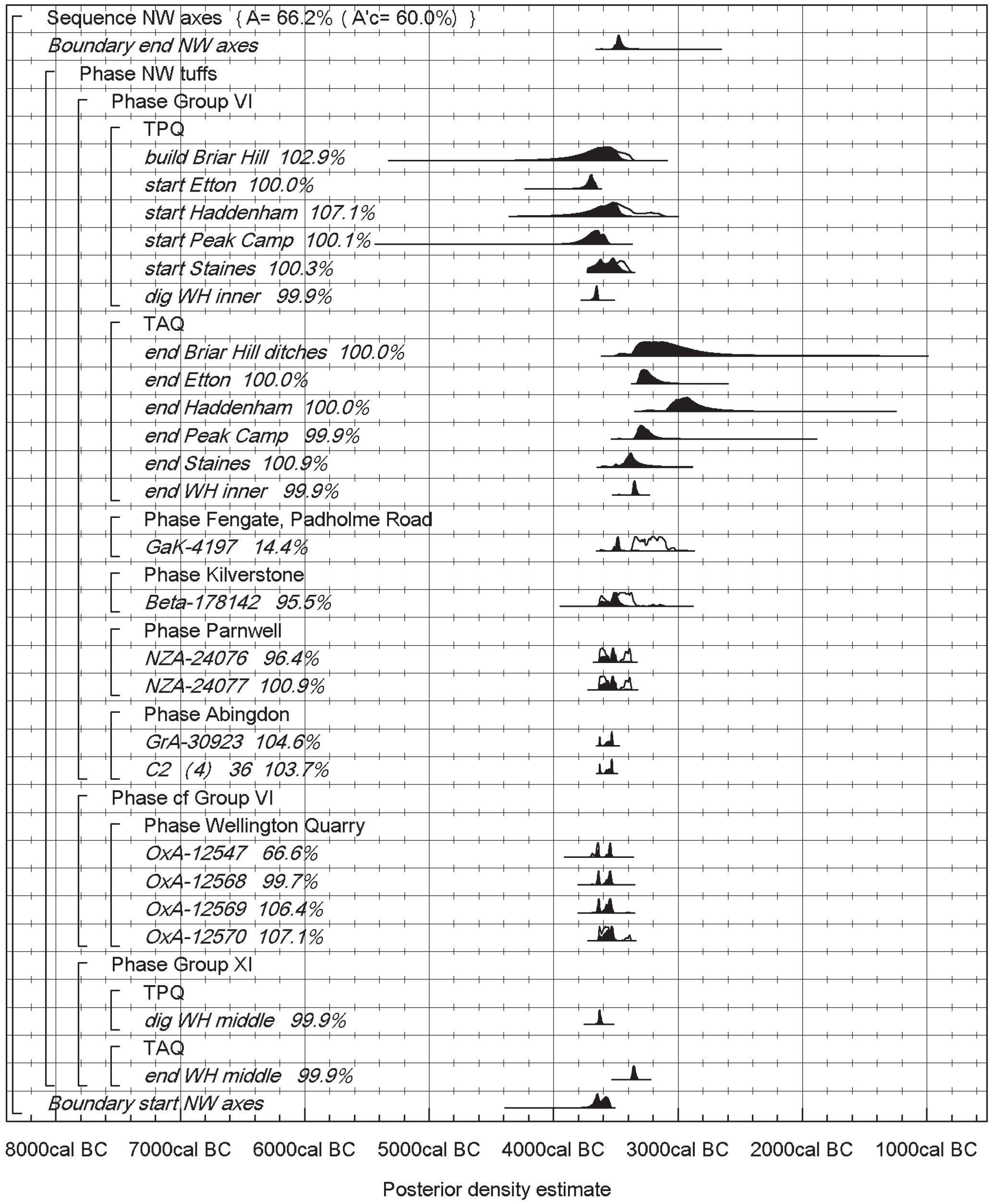


Fig. 14.122. Probability distributions of dates associated with early Neolithic ground stone axeheads from NW sources in southern Britain. The format is the same as for Fig. 14.1. Distributions have been taken from the models listed in the captions to Figs 4.2–4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the model exactly.

(Coles and Coles 1986, pl. 28). The artefact is attributed to a South Downs source by trace element analysis (Craddock *et al.* 1983, sample no. 362) and is compatible with the 'Cissbury axe' form of those made at the mine sites (Holgate 1995c, fig. 12: 3–7; Barber *et al.* 1999, fig. 2.6). This accords with the early fourth millennium start for flint extraction in Sussex indicated by the available radiocarbon dates. An overall model for the chronology of the early Neolithic use of the Sussex flint mines is shown in Fig. 14.129. This suggests that they were worked from *4145–3805 cal BC* (*95% probability*; Fig. 14.129: *start Sussex flint mines*), probably from *4020–3855 cal BC* (*68% probability*). This period of activity ended in *3635–3340 cal BC* (*95% probability*; Fig. 14.129: *end Sussex flint mines*), probably in *3620–3475 cal BC* (*68% probability*).

Figure 14.130 compares start dates for the South Downs mines, axeheads of distinctive flint, and stone axeheads from British sources in the south of England. It is apparent that flint mining and axehead manufacture in Sussex occurred from the early years of the Neolithic. The selection of distinctive, unmined flints for polished axeheads had begun by the 39th century cal BC. Flints identical to those of the bulk of the industries in which they occur may well have been used for axeheads as early or earlier. We have simply not found any dated examples from before the currency of causewayed enclosures. Axeheads of

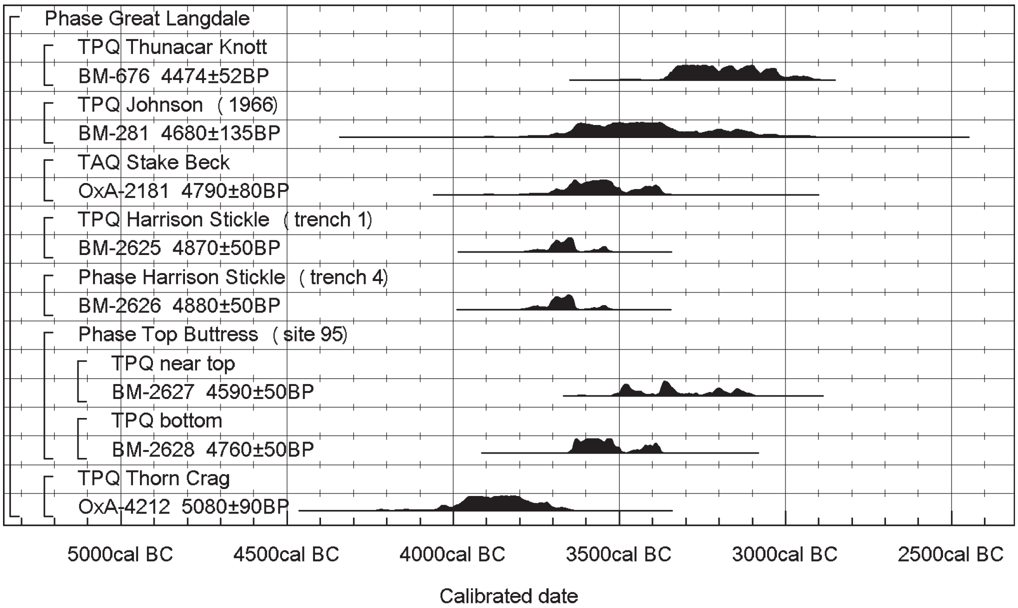


Fig. 14.123. Calibrated radiocarbon dates (Stuiver and Reimer 1993) from Great Langdale, Cumbria.

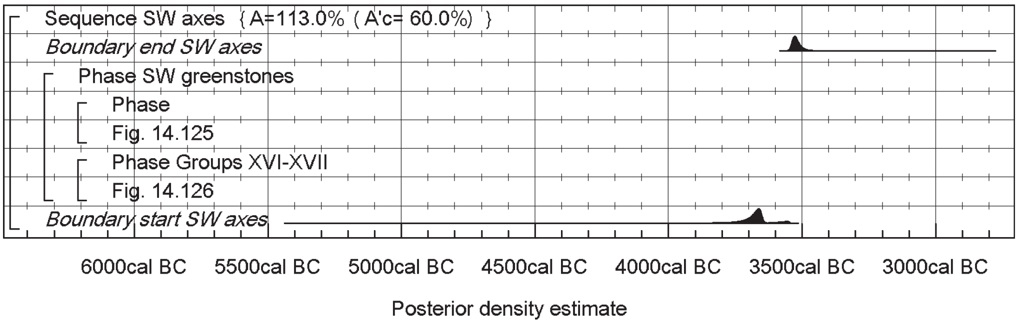


Fig. 14.124. Overall structure of the chronological model for the currency of early Neolithic ground stone axeheads from SW sources in southern Britain. The component sections of this model are shown in detail in Figs 14.125–6. The large square brackets down the left-hand side of the figures, along with the OxCal keywords, define the overall model exactly.

Table 14.13. Axeheads of distinctive flint relating to radiocarbon dates shown in Figs 14.114–17 and 14.118.

Site	**Sub-division**	**Comment/reference**	**Artefact type**	**Prior distribution**
South-east				
Kingsborough 1		M. Allen *et al.* 2008, fig. 10: 63, fig. 11:A	Axehead	Between *start Kingsborough 1* and *end Kingsborough 1*
South-central				
Staines		R. Robertson-Mackay 1987, 95	Axehead fragments and flakes	Between *start Staines* and *end Staines*
Abingdon		Avery 1982, 35	Axehead flakes	Between *start Abingdon* and *end Abingdon*
Ascott-under-Wychwood	Midden	Cramp 2007, 291, 292	Axehead flakes	Between *start Ascott pre-barrow* and *end Ascott pre-barrow*
Hazleton	Pre-cairn	Saville 1990, 154	Axehead flakes	Between *start pre-cairn Hazleton* and *end pre-cairn Hazleton*
Fir Tree Field	Hearth	French *et al.* 2007, fig. A4.2:3	Axehead fragment	*OxA-8009*
Whitesheet Hill		Rawlings *et al.* 2004, 160	Axehead flakes	Between *start Whitesheet Hill* and *end Whitesheet Hill*
Windmill Hill		I. Smith 1965a, 86, 102–3; J. Pollard 1999b, 330	Axeheads, fragments and flakes	Between *start Windmill Hill* and *end Windmill Hill*
South-west				
Carn Brea		Saville 1981, 138	Axehead fragments	Between *start Carn Brea* and *end Carn Brea*
Hembury		Liddell 1932, 178; 1935, 159	Axehead fragments and flakes	Between *start Hembury* and *end Hembury*

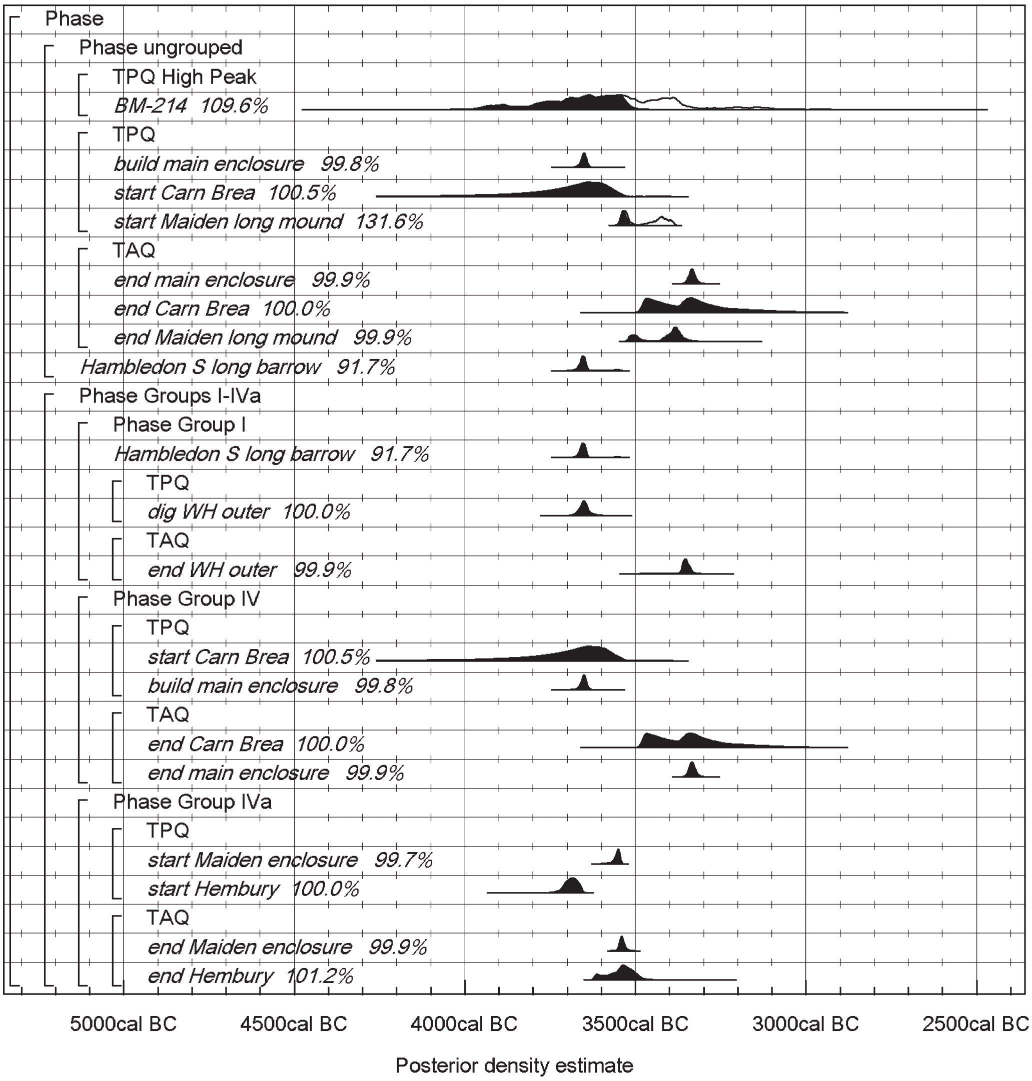


Fig. 14.125. Probability distributions of dates associated with early Neolithic ground stone axeheads from SW sources (ungrouped SW greenstones and Groups I, IV and IVa) in southern Britain. The format is identical to that for Fig. 14.1. Distributions have been taken from the models listed in the captions to Figs 4.2–4. The overall structure of this model is shown in Fig. 14.124, and its other component in Fig. 14.126.

distinctive flint and the imported continental jadeitites are the earliest dated ground axehead materials known from southern Britain, the insular stone sources coming into use in the 38th or 37th centuries cal BC. Figure 14.132 shows the intervals between the beginnings of these practices. The Sussex flint mines had been in use for a couple of centuries or so before the first ground stone axeheads from British sources came into circulation.

Figure 14.131 summarises the times when the main grouped English and Welsh stone sources began to be exploited. The first ground stone axeheads from insular sources appeared in southern Britain in the later 38th or earlier 37th century cal BC, including the products of both north-western and south-western sources. It is *81% probable* that the first axeheads from south-western sources were in use in southern Britain before the first from the north-west. This probably reflects the fact that the north-western sources lie outside the study area, so that their products may have been current earlier closer to the source. The south-western sources, on the other hand, however ill-defined, lie within the study area. Some of the dated enclosures are indeed so close to possible sources as to suggest that they were linked to their exploitation, notably Carn Brea and Group XVI, Helman Tor and Group XVII, and Hembury and Group IVa (Chapter 10).

The dates from early Neolithic contexts in Ireland containing Antrim porcellanite (group IX) are not modelled here. Its occurrence, however, in the Donegore and Magheraboy enclosures (Figs 12.5–9, and 12.15) and at sites such as the Ballygalley, Ballyharry and Monanny houses (Figs 12.22–7) indicates that, whatever the date of Magheraboy – discussed further below – the sources were being exploited by the 38th or early 37th century cal BC. Finds from court tombs and portal tombs (Sheridan *et al.* 1992, 406–7) also point to use in the fourth millennium, but provide little precision, given the state of the dating

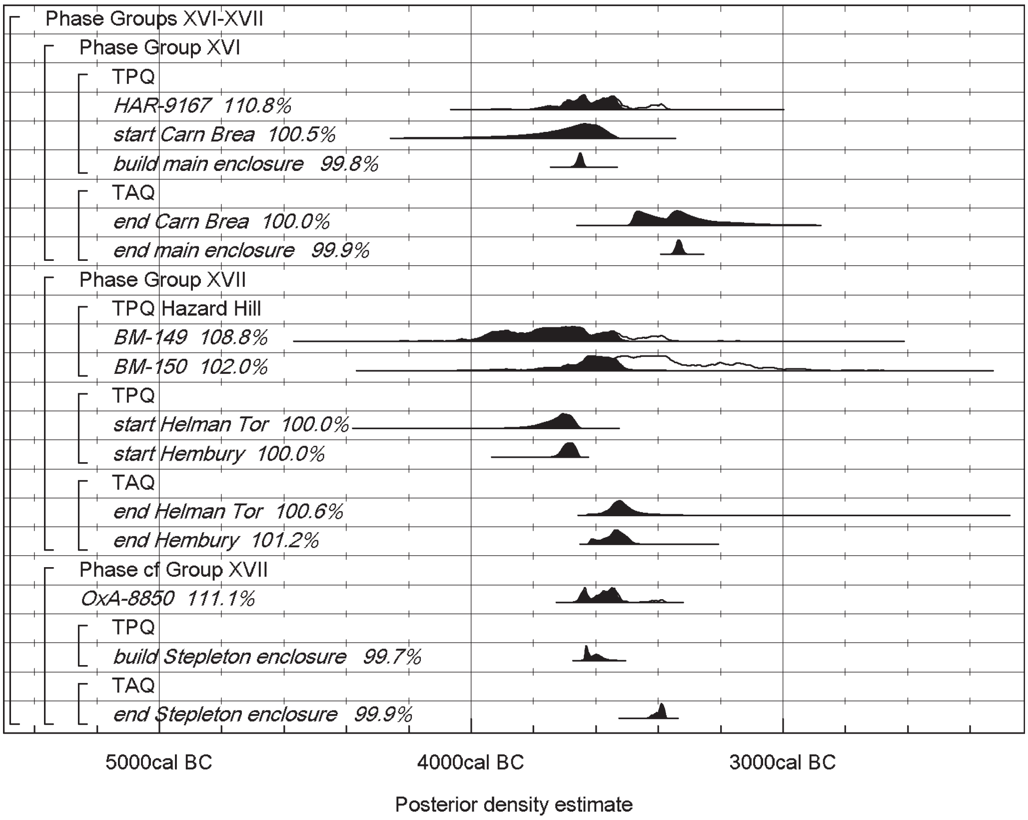


Fig. 14.126. Probability distributions of dates associated with early Neolithic ground stone axeheads from SW sources (ungrouped SW greenstones and Groups XVI and XVII) in southern Britain. The format is identical to that for Fig. 14.1. Distributions have been taken from the models listed in the captions to Figs 4.2–4. The overall structure of this model is shown in Fig. 14.124, and its other component in Fig. 14.125.

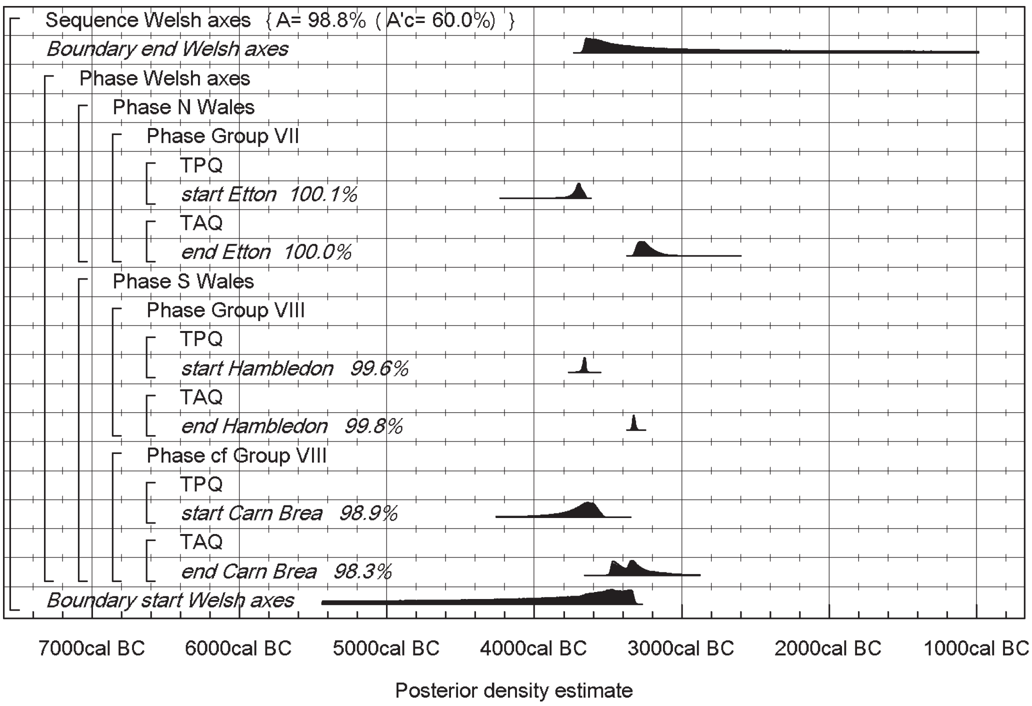


Fig. 14.127. Probability distributions of dates associated with early Neolithic ground stone axeheads from Welsh sources in southern Britain. The format is the same as for Fig. 14.1. Distributions have been taken from the models listed in the captions to Figs 4.2–4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the model exactly.

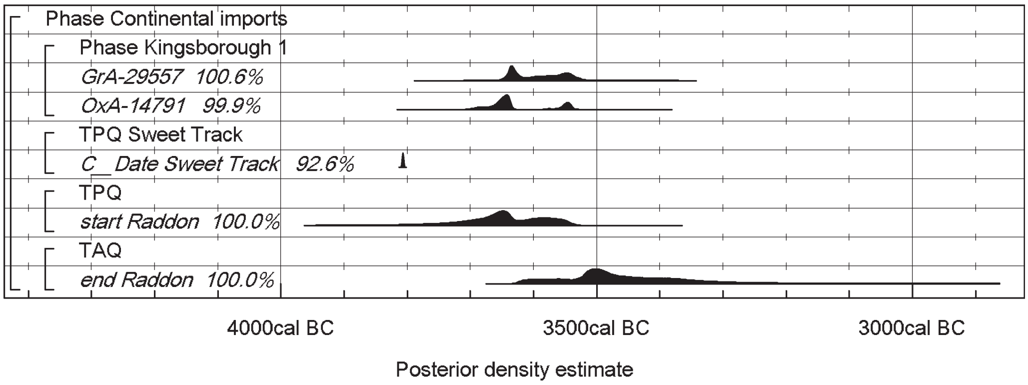


Fig. 14.128. Probability distributions of dates associated with certainly or possibly Continental ground stone axeheads in southern Britain. The distributions have been taken from the model defined in Figs 14.114–17.

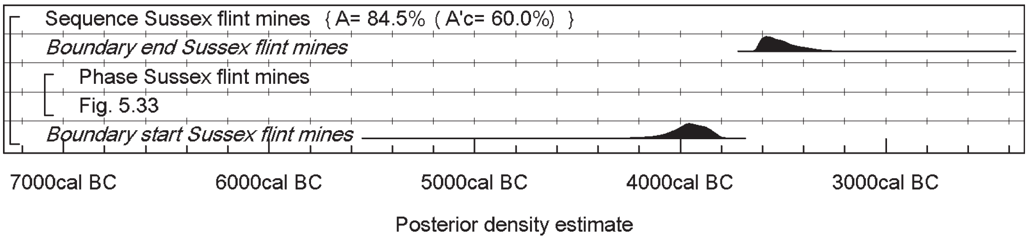


Fig. 14.129. Overall structure of the chronological model for the early Neolithic use of the Sussex flint mines. The component section of this model is shown in detail in Fig. 5.33 (although the posterior density estimates shown on this figure are not those relating to this model). The large square brackets down the left-hand side of these figures, along with the OxCal keywords, define the overall model exactly.

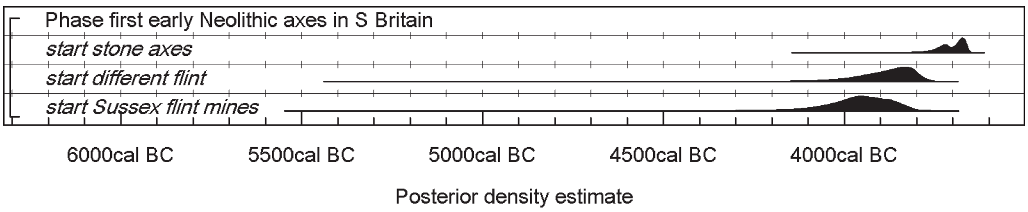


Fig. 14.130. Probability distributions of dates for the first ground stone axeheads in southern Britain, for the first ground axeheads made from distinctive flint, and for the beginnings of the Sussex flint mines, derived from the models defined in Figs 14.118, 14.119–21 and 14.129 (and its component part).

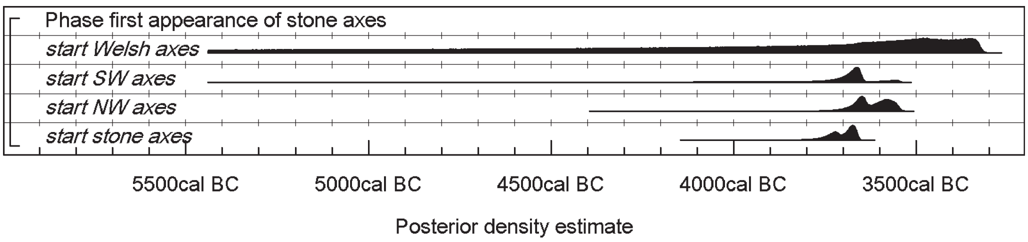


Fig. 14.131. Probability distributions of dates for the first appearance of ground stone axeheads from insular sources in southern Britain, derived from the models defined in Figs 14.127, 14.124–6, 14.122 and 14.119–21.

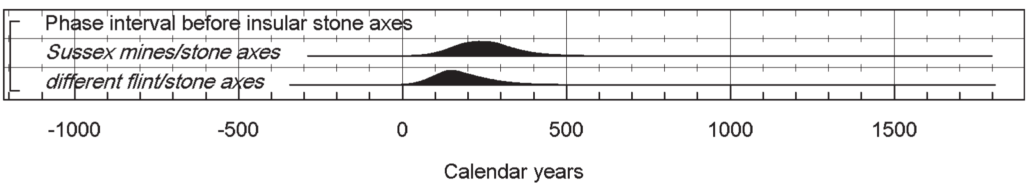


Fig. 14.132. Intervals between the first insular ground stone axeheads in southern Britain and the start of the Sussex flint mines and the first use of distinctive flint for ground axeheads, derived from the models defined in Figs 14.129, 14.118, and 14.119–21.

of these monument types (Chapter 12.3). On Lambay Island, dating at the source points to a fairly short period of porphyry exploitation for axehead production falling in the 38th or 37th centuries cal BC (Fig. 12.30).

The time when these various axehead types ceased to be deposited in early Neolithic contexts in southern Britain is shown in Fig. 14.133. None need have been deposited after the earlier 35th century cal BC, and the production of these objects may have declined at this time. It is noteworthy that stone axeheads are much scarcer than flint ones in Peterborough Ware associations but frequent (especially artefacts from south-western sources) in Grooved Ware ones (Bradley and Edmonds 1993, 55). Those authors' interpretations of different but contemporary sets of practices or ranked spheres of exchange might now be revised into a sequence of attenuation of exchange networks followed by their revival, accompanied by new meanings for the materials and objects themselves.

Things on the move

The models so far presented have made no allowance for the distances over which objects would have been transported. This is significant for the nature and scale of contact and exchange, and long-distance movement of artefacts may have occurred by several processes, or combinations of processes. Obvious examples include carriage by individuals in the course of fairly long journeys; hand-to-hand exchange over a series of short legs; and bulk transport, probably by water or pack animals. In the early Neolithic of southern Britain, stone axeheads and gabbroic pottery are the archaeologically visible commodities which were transported over the greatest distances. In the models which follow, non-local findspots are defined by an arbitrary limit of 75 km and dates from sites closer than this to the sources are excluded.

The model estimating the period during which ground axeheads from British sources were transported over distances of more than 75 km is shown in Figs 14.134−6. These include the flint axeheads from Carn Brea, where 'The flint type of which the axeheads are made is both varied and unidentifiable, and contrasts with the raw material otherwise exploited on the site. The implication is that these are imported implements' (Saville 1981, 138). The nearest sources of non-beach flint are in Devon (Newberry 2002). The model suggests that long-distance transport of insular stone axeheads began in *3725–3635 cal BC* (*95% probability*; Fig. 14.134: *start stone axe networks*), probably in *3680–3645 cal BC* (*68% probability*). This network declined in *3540–3440 cal BC* (*95% probability*; Fig. 14.134: *end stone axe networks*), probably in *3515–3460 cal BC* (*68% probability*).

A similar model, for the period during which gabbroic pottery fabrics were used for early Neolithic pots found more than 75 km from their source in southern Britain is shown in Fig. 14.137. This model suggests that gabbroic pottery was moved significant distances from *3805–3645 cal BC* (*95% probability*; Fig. 14.137: *start gabbroic import*), probably in *3715−3650 cal BC* (*68% probability*). This movement finished in *3555–3465 cal BC* (*95% probability*; Fig. 14.137: *end gabbroic import*), probably in *3550–3515 cal BC* (*68% probability*).

Figure 14.138 shows the period during which long-distance movement of objects is evidenced in the early Neolithic in southern Britain. It is apparent that these networks were probably established in the early 37th century cal BC, and that they may have shut down in the earlier 35th century cal BC. Earlier suggestions that exchange networks became more extensive from *c*. 3400 cal BC and that non-local stone axeheads occurred only late in the sequences at already well established enclosures (e.g. Bradley and Edmonds 1993, 40, 177) do not fit with an enlarged body of stratified and dated artefacts and a more precise chronology. Hambledon Hill provides a telling illustration: the primary silts of the south long barrow there, built in *3680–3635 cal BC* (*95% probability*; Fig. 4.10: *Hambledon S long barrow*), probably in *3665–3645 cal BC* (*68% probability*), included a sherd of gabbroic ware, a flake from an ungrouped south-western greenstone axehead, and a fragment of a Group I axehead (Mercer and Healy 2008, 143–4). Further gabbroic ware and south-western axehead fragments occurred within the primary use of the complex (Mercer and Healy 2008, tables 9.13, 10.2). Two pits are noteworthy. One in the main enclosure contained a Group XVI axehead and two gabbroic bowls (Mercer and Healy 2008, fig. 3.54). Another in the Stepleton enclosure lacked artefacts of south-western origin but contained a substantial early Neolithic assemblage (Mercer and Healy 2008, 292), together with charred fragments of *Erica vagans*, a heath which now grows only on the Lizard peninsula and in Northern Ireland (Austin *et al*. 2008). It is strongly suggestive of packing material and hence direct transport.

Group VI implements, dominant in eastern English enclosures, were found within the primary use, although above the initial silts, of Etton, Haddenham, Staines, Briar Hill, Peak Camp and Windmill Hill. Although they came into circulation in southern Britain later than those from south-western sources, they did so in *3705–3540 cal BC* (*95% probability*; Fig. 14.122: *start NW axes*), probably in *3670–3630 cal BC* (*29% probability*) or *3610–3555 cal BC* (*39% probability*), only slightly later than the start of enclosure building in *3765–3695 cal BC* (*95% probability*; Fig. 14.1: *start S British enclosures*), probably in *3740–3705 cal BC* (*68% probability*).

Figure 14.139 estimates the amount of time between the first appearance of stone axeheads from the south-west and Wales or gabbroic pottery near their sources, and the time when they were transported long distances (e.g. the difference between *start stone axes* and *start stone axe networks* in Figs 14.119 and 14.134). For both types of material the networks appear to have been established very quickly, probably within a generation or two; indeed, both may have circulated in a single network. This short interval applies only to sources in the south-west peninsula and Wales, since the north-western sources are well outside the study area.

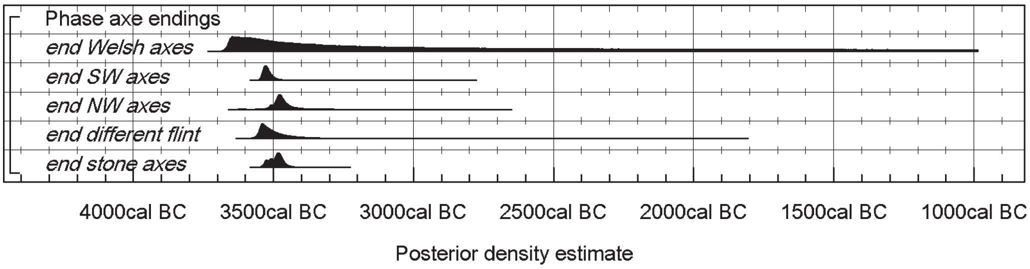


Fig. 14.133. Probability distributions of dates for the last appearance of various ground axehead types in early Neolithic contexts in southern Britain, derived from the models defined in Figs 14.118, 14.119–21, 14.122, 14.124–6 and 14.127.

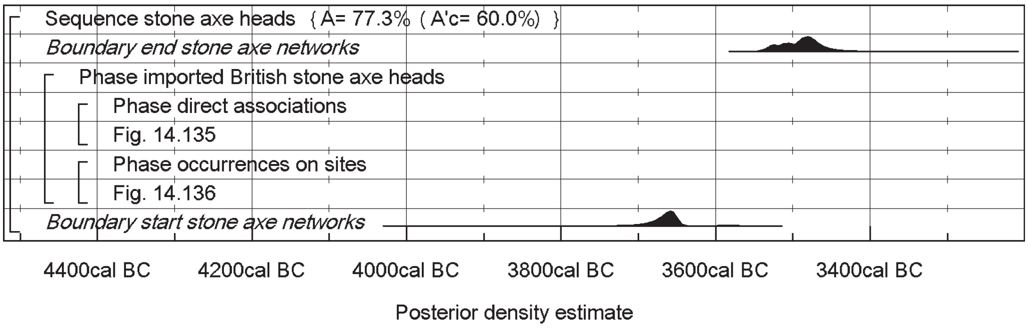


Fig. 14.134. Overall structure of the chronological model for the period when insular ground stone axeheads were transported distances of more than 75 km from their source in the early Neolithic. The component sections of this model are shown in detail in Figs 14.135–6. The large square brackets down the left-hand side of the figures, along with the OxCal keywords, define the overall model exactly.

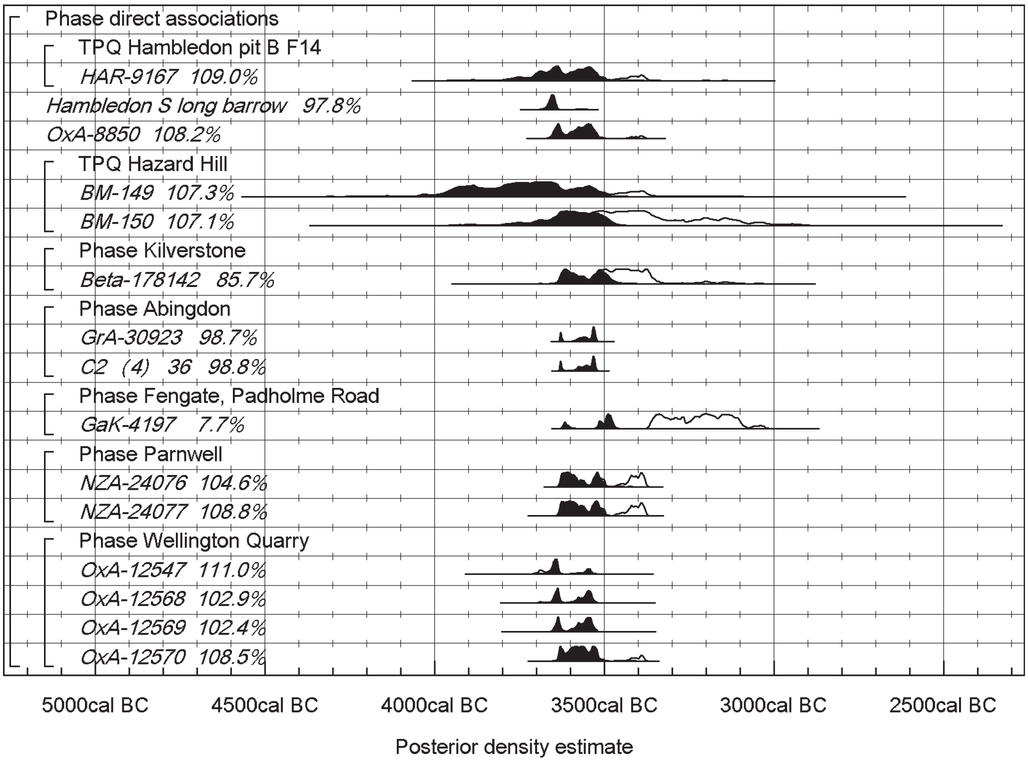
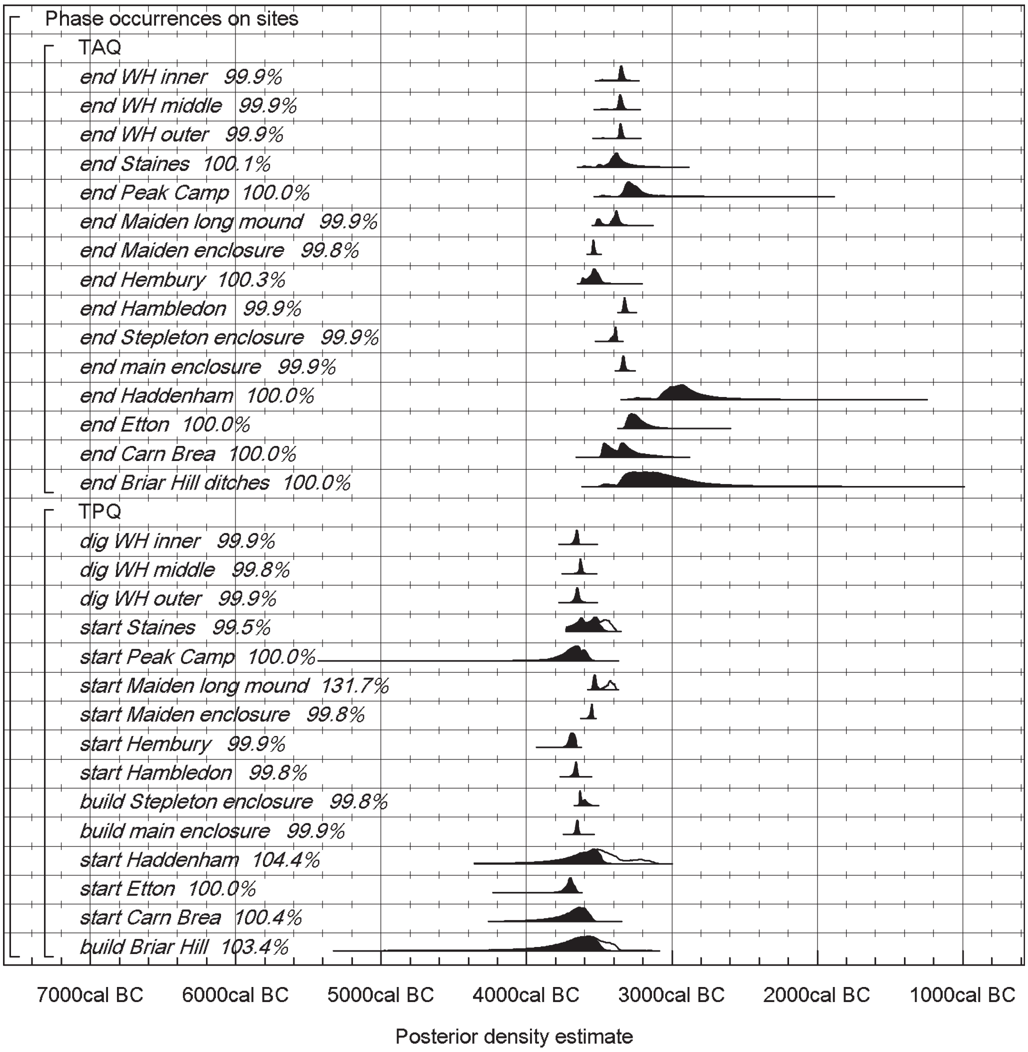


Fig.14.135. Probability distributions of dates from southern Britain associated with insular ground axeheads of stone or distinctive flint found more than 75 km from their source. The format is identical to that for Fig. 14.1. Distributions have been taken from the models defined in Figs 4.7–13 (Hambledon Hill) and Figs 8.18–21 (Abingdon). The overall structure of this model is shown in Fig. 14.134, and its other component in Fig. 14.136.



14.136. Probability distributions of dates from southern Britain associated with insular ground axeheads of stone or distinctive flint found more than 75 km from their source. The format is identical to that for Fig. 14.1. Distributions have been taken from the models listed in the captions to Figs 4.2–4. The overall structure of this model is shown in Fig. 14.134, and its other component in Fig. 14.135.

It is noteworthy that the Sussex enclosures do not figure at all in this. They lie outside the range of gabbroic wares; and the only stone object from an upland area is a fragment of granite without obvious sign of working, probably from Devon or Cornwall, found in the inner ditch at Offham (Drewett 1977, 218). The absence of stone axeheads marks them out from enclosures to the west, east and north and corresponds to a local scarcity of stone axeheads from all sources (Woodcock *et al.* 1988, fig. 4). The early establishment of the Sussex flint mines must be significant here. Some of the flint axeheads from the Sussex enclosures, both flaked and ground, are of the 'Cissbury' type made at the mines. There are examples from Whitehawk (Ross Williamson 1930, pl. XIII; Curwen 1936, fig. 320) and Bury Hill (Bedwin 1981, fig. 5), as well as the cache of three ground axeheads from Combe Hill (Drewett 1994, fig. 12). Four axeheads from Whitehawk have actually been attributed to South Downs sources by trace element analysis (Craddock *et al.* 1983, sample nos 699, 700, 703, 713). This tallies with the overlap between the use-lives of the mines and the enclosures and suggests that the mines and their products had considerable significance. Direct links between enclosures and particular groups of mines, like those proposed by Drewett *et al.* (1988, 60–2), may well have obtained, but are difficult to demonstrate on spatial grounds because the mines are concentrated on a block of downland between the two groups of Sussex enclosures, the only exception being the proximity of the Long Down mines to the probably Neolithic enclosure on Halnaker Hill (Fig. 5.1).The Sussex enclosures and their hinterland were, however, within the networks through which south-western and north-western artefacts were brought to lowland Britain, since axeheads from the South Downs reached not only the Somerset Levels, within the south-western network, but also East Anglia (Craddock *et al.* 1983, fig. 2), where axeheads from north-western sources are frequent (Clough and Cummins 1988, map 6).

While only three even possibly continental axeheads

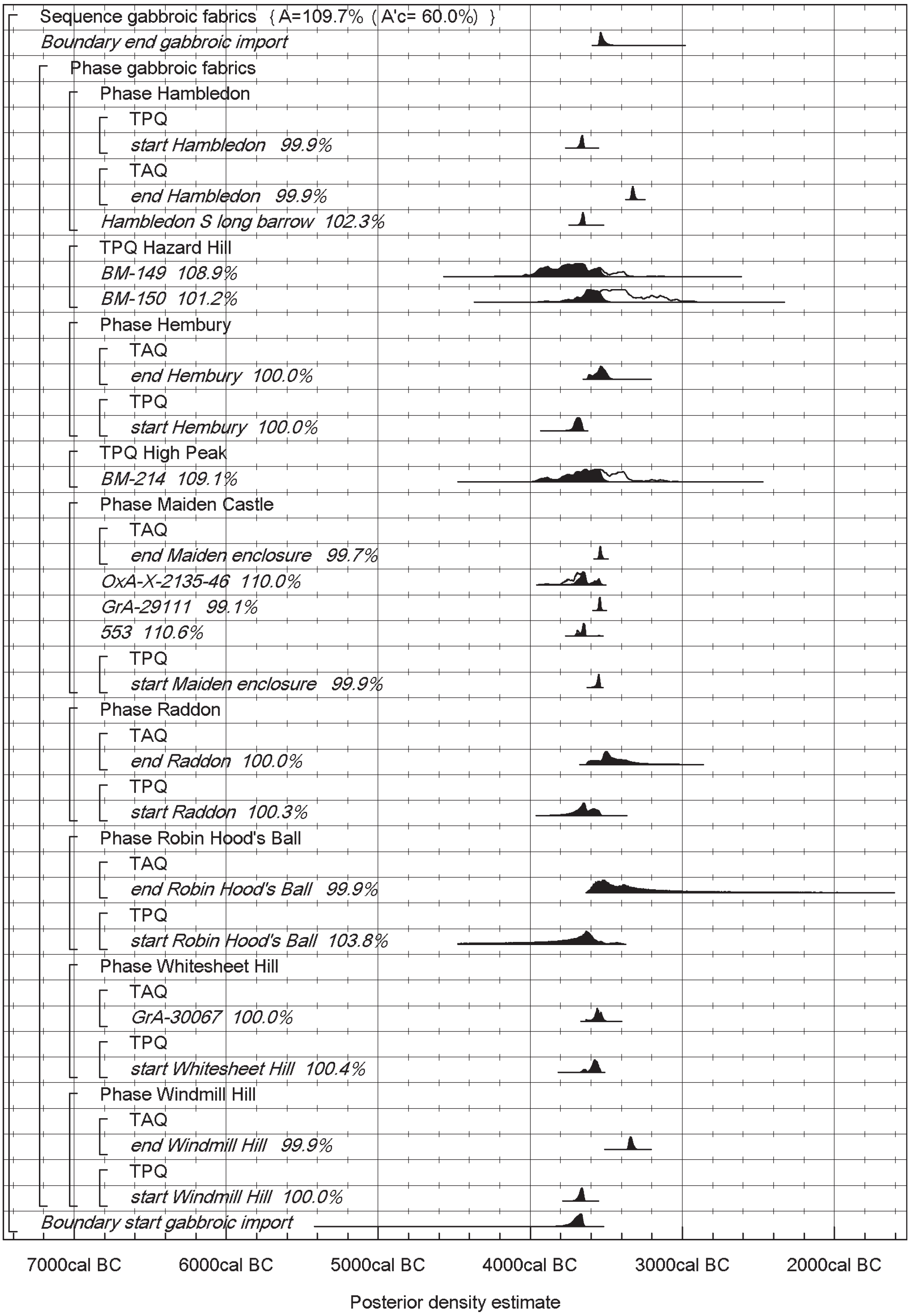


Fig. 14.137. Probability distributions of dates from early Neolithic contexts in southern Britain associated with gabbroic pottery fabrics found more than 75 km from the source. The format is the same as for Fig. 14.1. Distributions have been taken from the models listed in the captions to Figs 4.2–4. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the model exactly.

from Britain can be dated, they suggest that contacts may have been maintained after the 39th century cal BC deposition of the Sweet Track jadeitite axehead (Fig. 14.128). The impression of continued contact is reinforced by stray finds. Five products of the quarry and axehead-making site at Plussulien in Brittany have been found in southern England (Clough and Cummins 1988, map 10; Le Roux 1999, figs 59–60). Their source is seen as having been exploited from the late fifth millennium cal BC to the end of the third (Le Roux 2002, 107). This chronology

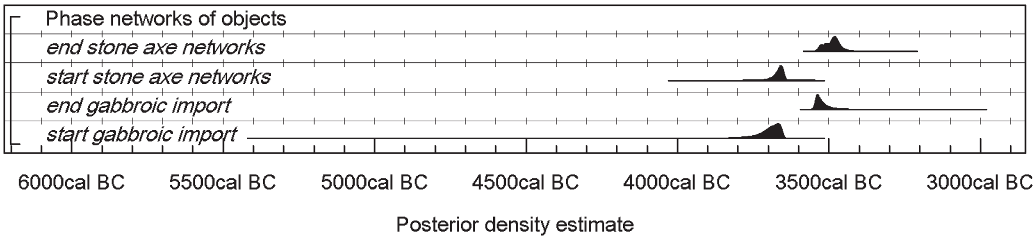


Fig. 14.138. Probability distributions for the period during which gabbroic pottery fabrics and insular stone axeheads were deposited in early Neolithic contexts in southern Britain, derived from the models defined in Figs 14.134–6 and 14.137.

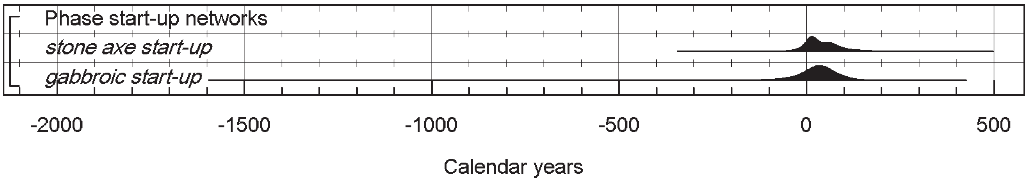


Fig. 14.139. Intervals between the first insular ground stone axehead in southern Britain and the start of long-distance axe movement, and between the first pottery in gabbroic fabrics and the start of its long-distance movement, derived from the models defined in Figs 14.119–21, 14.134–6, 14.104–6 and 14.137.

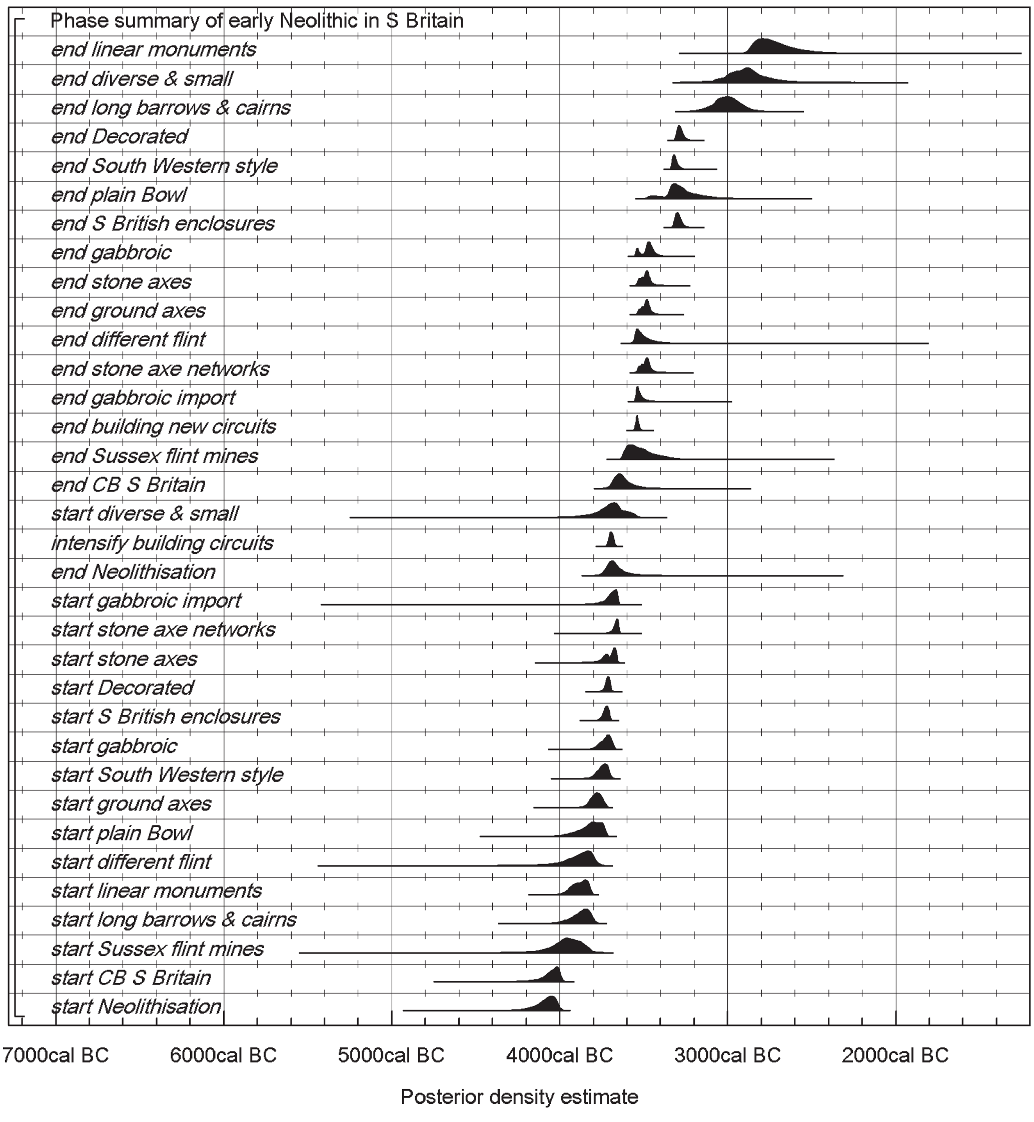


Fig. 14.140. Probability distributions of dates for entrances and exits of early Neolithic things and practices in southern Britain, taken from the models defined in Figs 14.1, 14.7, 14.39, 14.43, 14.44, 14.54, 14.88, 14.90, 14.92, 14.101, 14.104, 14.118, 14.119, 14.129, 14.134 and 14.137 (with their component parts where appropriate).

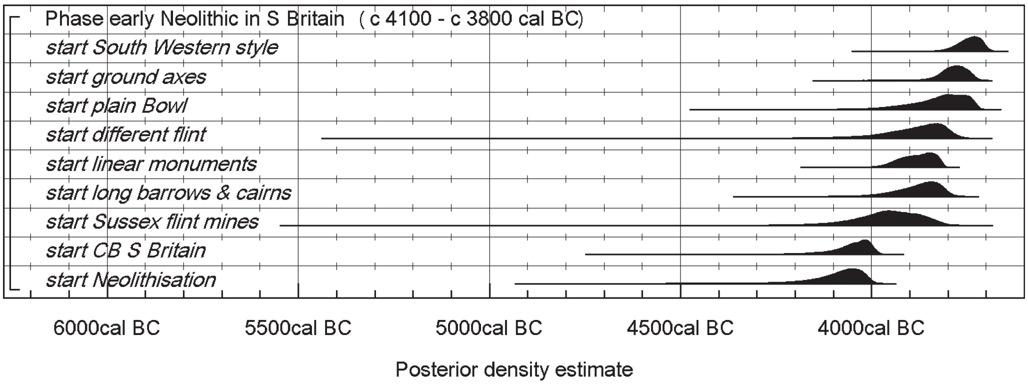


*Fig. 14.141. Probability distributions of dates for entrances of early Neolithic things and practices in southern Britain (*c. *4100–*c. *3800 cal BC), taken from the models defined in Figs 14.39, 14.44, 14.54, 14.88, 14.90, 14.101, 14.118, and 14.129 (with their component parts where appropriate).*

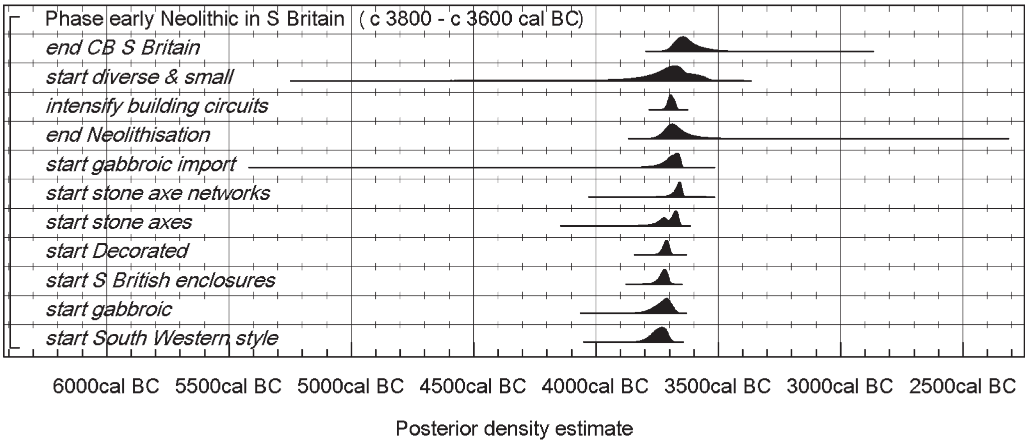


*Fig. 14.142. Probability distributions of dates for entrances and exits of early Neolithic things and practices in southern Britain (*c. *3800–*c. *3600 cal BC), taken from the models defined in Figs 14.1, 14.7, 14.43, 14.54, 14.88, 14.92, 14.101, 14.104, 14.119, 14.134 and 14.137 (with their component parts where appropriate).*

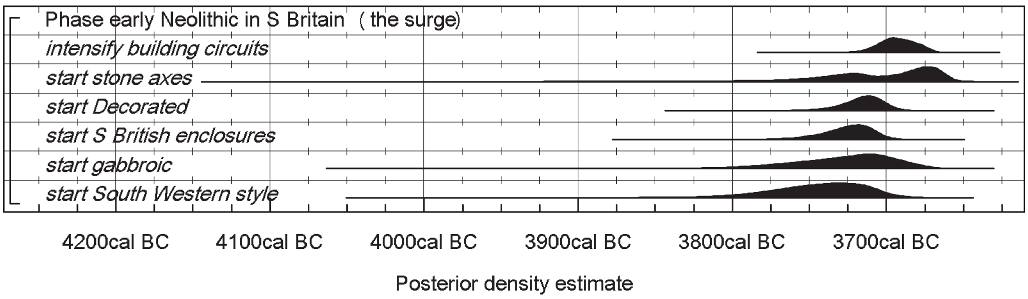


*Fig. 14.143. Probability distributions of dates for the surge in innovative early Neolithic things and practices in southern Britain (*c. *3750–*c. *3675 cal BC), taken from the models defined in Figs 14.1, 14.7, 14.92, 14.101, 14.104 and 14.119 (with their component parts where appropriate).*

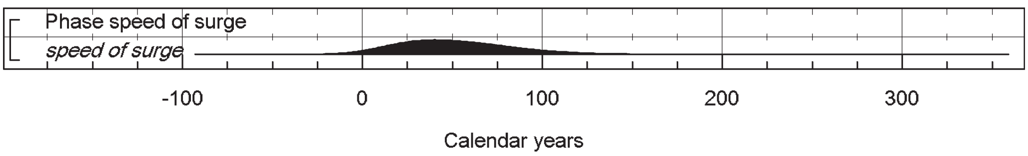


Fig. 14.144. Probability distribution of the period between the introduction of the South-Western style of pottery and the intensification of circuit construction at causewayed enclosures, marking the speed of the surge (derived from the distributions shown in Fig. 14.143).

is based on the contexts and typology of artefacts found elsewhere and on 22 radiocarbon dates measured on unidentified bulk charcoal samples from the workings, 14 of them from a stratified sequence (Le Roux 1999, 45–69). The excavator's difficulty in reconciling measurements and sequence, in which older results were sometimes stratified above younger ones (Le Roux 1999, 55–6), heightens the probability that some if not all of these measurements are *termini post quos* and suggests that exploitation may have started in the fourth rather than the fifth millennium, some time after dates for two small hearths at the base of the main sequence (95% confidence; 4940±115 BP; 3980–3380 cal BC; Gif-2682; and 4960±110 BP; 3990–3520 cal BC; Gif-2330; Le Roux 1999, fig. 15).

One of the English finds is an *hache à bouton*, likely on grounds of typology and association to date to the early third millennium cal BC (Le Roux 1999, 146–7; 2002, 111), but some or all of the remaining four could date back to the fourth millennium. Also relevant to the question of continental contact is the recognition of a group of very finely finished polished flint axeheads of a distinctive banded flint, again all stray finds, for which a Scandinavian source has been suggested, consonant with their predominantly east coast distribution (Saville 1999b; 2004a; Sheridan 1992, 208–10).

The long-distance transport of finished objects, in small quantities, was one end of a spectrum of exchange and transportation. Larger quantities of materials and artefacts were carried over shorter distances, in circumstances where one might envisage single-leg journeys and water-born or animal transport. The numbers of cattle slaughtered at some briefly and occasionally used Wessex enclosures must have been driven there. Those consumed at Hambledon, for example, did not reflect the complete cull of a sustainable herd, but were selected from their herds and brought there to be eaten (Legge 2008), and preliminary results of isotopic analysis of some of the cattle bone from Windmill Hill indicate that they were reared off the Chalk (Hege Usborne, pers. comm.). Cattle elsewhere may have travelled equally long distances. These animals also provide an obvious medium for the transport of relatively bulky and heavy loads. Both cattle and their putative loads may reflect the catchments of enclosures. Some detectable examples are noted here, although their appearance has not been formally modelled.

Nodular flint was carried into Cornwall from sources in Devon or farther away from at least the 37th century cal BC, given its use at Tregarrick Farm (Lawson-Jones 2003, 125), Helman Tor (Saville 1997), and Carn Brea (Saville 1981, 107–8), and into the Cotswolds, probably from the Wessex Chalk, as early as the 39th century cal BC, given its use in the pre-cairn occupation at Ascott-under-Wychwood (Cramp 2007, 291–2). The start of its transport into Wales (e.g. P. Bradley 1999, 50–1) is undated. Quern materials were also transported from an early stage. In the Cotswolds, fragments of May Hill gritstone formed part of the pre-tomb occupation deposit at Hazleton, some 40 km from the source, and a quern of the same material was built into the cairn at Burn Ground (Roe 2009, 27), although it is not clear at what stage in the probably long use-life of the monument (Fig. 9.25) it was inserted. In Wessex, Old Red Sandstone from the Mendips was transported over at least 40 km to Hambledon, where it was the main quern and rubber material of the main enclosure (Roe 2008, 634–5), and was present from the start of the sequence (Roe 2008, table 10.3). Non-local quern materials were also brought over relatively short distances to sites in the Thames valley, including the Staines causewayed enclosure and Eton Rowing Course (Roe 2009, 28–9).

The widespread use on the Wessex Chalk of pottery made of clay from Jurassic deposits to the north and west (Cleal 1995b) is another case of relatively short-distance, large-scale transport. At Hambledon vessels in this group of fabrics, from some 25–60 km away, and others from a non-Jurassic source to the south, some 30–40 km away, increased in frequency through the sequence (Mercer and Healy 2008, figs 3.67, 3.130), suggesting that, if they were brought by those frequenting the complex, its catchment may have expanded. In the south-west peninsula, up to half of the Hembury assemblage seems to be in a family of Carboniferous vein quartz fabrics originating near Raddon some 20 km to the west (Quinnell 1999, 48).

14.6 The southern British early Neolithic: an historical narrative

We are now in a position, for the first time, to attempt to write a narrative of the early Neolithic in southern Britain. This is summarised in Fig. 14.140. It is apparent that the pace of change is not constant through the centuries in question.

The first Neolithic things and practices probably appeared in southern Britain in the 41st century cal BC (Fig. 14.141). This initial Neolithic included at least the presence of Carinated Bowl. This first Neolithic presence, however, was probably not synchronous across southern Britain (Fig. 14.54), and may have spread generally outwards from the south-east corner of England. Other elements of the first centuries of the early Neolithic include flint mines in Sussex and, perhaps beginning slightly later, the first long barrows and long cairns, and the first linear monuments (though not yet 'classic' cursus monuments). At this time, probably during the course of the 39th century cal BC, plain Bowl assemblages without the diagnostic characteristics of Carinated Bowl appeared, and distinctive types of flint (not from the Sussex mines) were selected for the manufacture of ground axeheads. Here, we have not estimated independently the dates when cereals and domesticated animals were introduced (because of the current need to define the end as well as the beginning of a phase of activity in our models), but it is clear that they were both present in these early centuries – cereals from the substantial rectangular house at White Horse Stone in Kent (Chapter 7.6) and domesticated cattle, sheep and pig from the pre-barrow occupation at Ascott-under-Wychwood, Oxfordshire (Chapter 9.4).

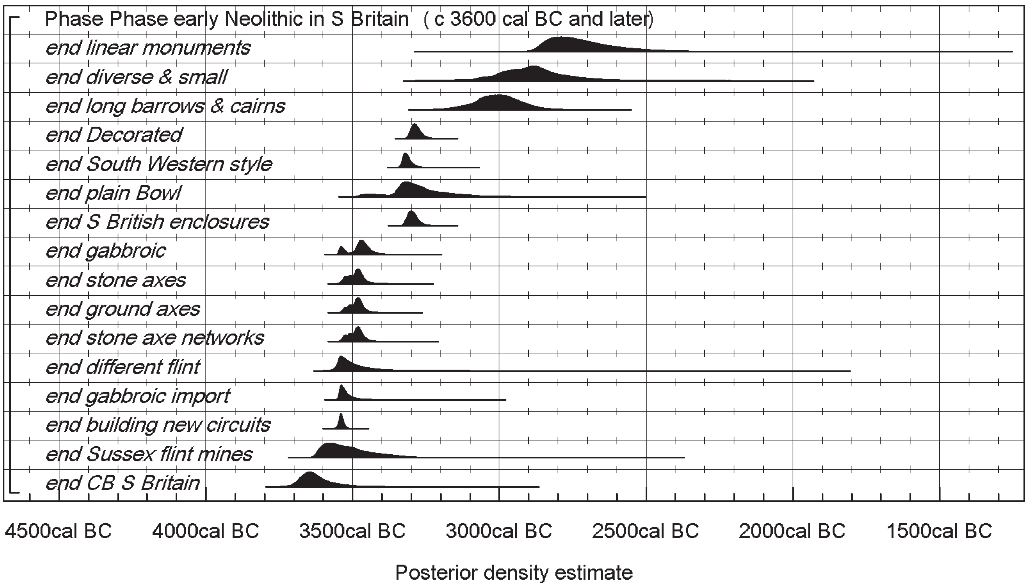


*Fig. 14.145. Probability distributions of dates for exits of early Neolithic things and practices in southern Britain (*c*. 3600 cal BC and later), taken from the models defined in Figs 14.1, 14.7, 14.39, 14.43, 14.44, 14.88, 14.90, 14.92, 14.101, 14.104, 14.118, 14.119, 14.129, 14.134 and 14.137 (with their component parts where appropriate).*

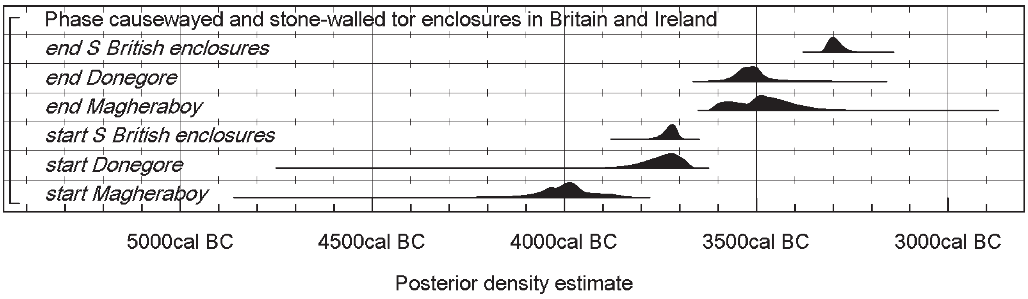


Fig. 14.146. Probability distributions of dates for the use of causewayed and related enclosures in Britain and Ireland, taken from the models defined in Figs 12.5–9, 12.15 and 14.1–4.

During the 38th century cal BC, the pace of change intensified markedly (Fig. 14.140). This is shown in Fig. 14.142, and in more detail in Fig. 14.143. Within the space of two or three generations (Fig. 14.144), the people of the south-west peninsula developed the South-Western style of pottery and began to exploit gabbroic clays; further east, people developed Decorated Bowl pottery and constructed the first causewayed enclosures. By this time, the first Neolithic things and practices had spread right across southern Britain, reaching south Wales and the Marches. As enclosure construction intensified during the early decades of the 37th century cal BC, long-distance networks for the movement of axeheads and gabbroic pottery were developed within Britain (in contrast to the network represented by the import of continental jadeitite, seen at the Sweet Track from the very end of the 39th or the very beginning of the 38th century cal BC). This startling array of innovation may have arisen within the span of an individual lifetime. It is hard to unpick causality within this veritable surge of change. Did the building and use of enclosures lead to the establishment of other new practices and the widening of social and material networks? Or did the changes of the 38th century cal BC produce the enclosure phenomenon? In the present state of knowledge, it is too close to call the answer, but we have dramatically narrowed the timeframe to the point where we need to consider the agency of two or three specific human generations.

Another uncertainty concerns the disparate collection of diverse and small monuments, the date estimate for the appearance of which is imprecise (Fig. 14.142). Some of these may have been first built and used as part of the surge of innovation of the later 38th into the earlier 37th century cal BC, or have been part of the intensifications of the mid-37th century cal BC. This uncertainty is important, because their small size stands in important contrast to the great collective goings-on witnessed at enclosures. Oval barrows too remain imprecisely dated but appear to fall in the second half of the fourth millennium cal BC (Fig. 14.42). So their apparent focus on individuals, at least in cases like Whiteleaf (Chapter 6.1.2) and Mount Farm (Chapter 8.6), may also stand in contrast to the collective focus of enclosures and long barrows.

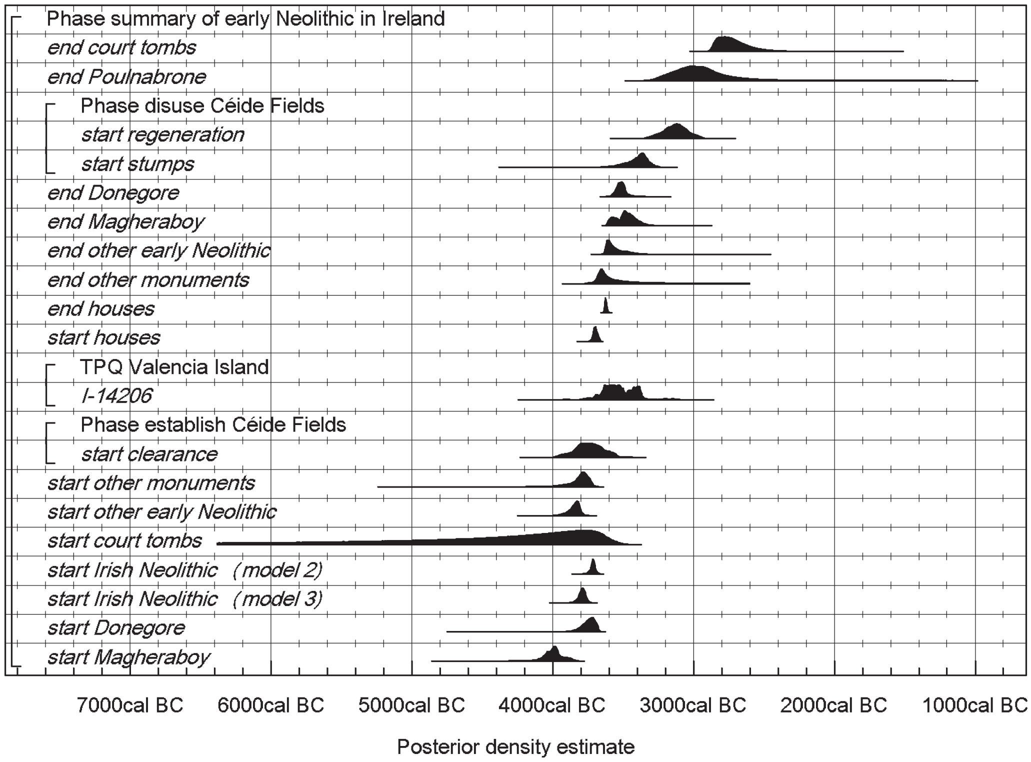


Fig. 14.147. Probability distributions of dates for entrances and exits of early Neolithic things and practices in Ireland, taken from the models defined in Figs 12.5, 12.15, 12.22, 12.30, 12.31, 12.32, 12.35, 12.37, 12.39, 12.54 and 12.56 (with their component parts where appropriate).

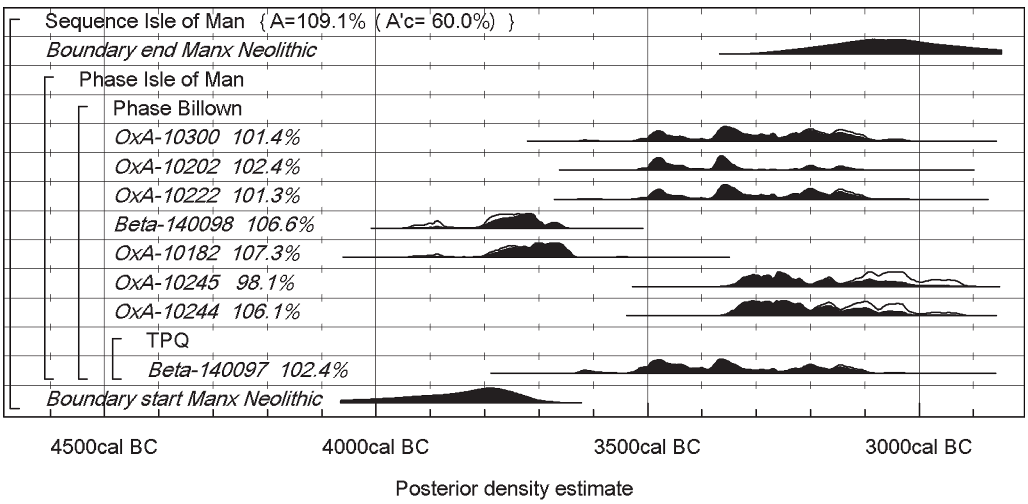


Fig. 14.148. Probability distributions of dates associated with diagnostically early Neolithic material culture from the Isle of Man. The format is the same as for Fig. 14.1. The large square brackets down the left-hand side of these diagrams, along with the OxCal keywords, define the overall model exactly.

This dynamic history continued. By the final quarter of the 37th century cal BC, enclosure construction was at its most intense across southern Britain (Fig. 14.20), but this was also a time when some at least of the long barrows and long cairns were ending (Bayliss and Whittle 2007). Was there a causal link between these events? In the earlier part of the 36th century cal BC, there was a slackening in the pace of enclosure circuit construction, before renewed efforts in the middle of the 36th century (Fig. 14.20), which constitute the last main bout of fresh enclosure building. Perhaps from the 36th century cal BC onwards, people started building the very different cursus monuments, as suggested by the dating evidence from Drayton (Chapter 8.6: where the problems of bimodality have been stressed) and Stonehenge (Chapter 4.4). In the generations around 3500 cal BC, as building new enclosures declined in

Fig. 14.149. Map of Scotland showing sites mentioned in the text.

fashion, it appears that the networks of movement of axeheads and gabbroic pottery also wound down (although at present our dating of these networks is too closely bound up with that for enclosures themselves for us to be entirely sanguine about the reliability of this picture). A single event, the battle of Crickley Hill, probably falling in the first half of the 35th century cal BC, may stand at the beginning of the end of the set of things and practices which we have put under the label of the early Neolithic.

Further endings and transformations followed. Decorated Bowl ceased to be deposited by around 3300 cal BC. Primary activity at even the most enduring of the causewayed enclosures also ended at this time (although this is partially a product of our definition of primary use as being associated with Bowl pottery!). The currency of South-Western style pottery also appears to have ended around this time, and probably also that of plain Bowl (Fig. 14.145). By this time too, it is probable that more cursus

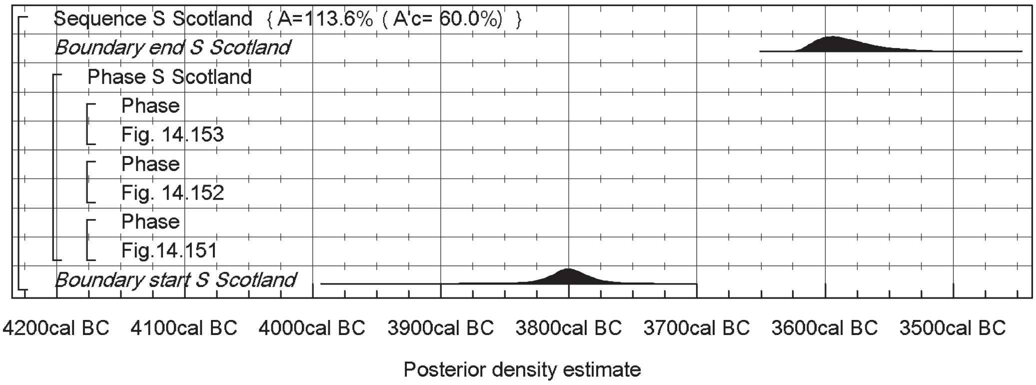


Fig. 14.150. Overall structure of the chronological model for early Neolithic activity in southern Scotland. The format is identical to that for Fig. 14.1. The components of the model are given in detail in Figs 14.151–3. The large square brackets down the left-hand side of Figs 14.150–3, along with the OxCal keywords, define the overall model exactly.

monuments had been constructed (Barclay and Bayliss 1999, figs 2.2 and 2.5). The start of Peterborough Ware has been largely beyond the reach of this project and awaits formal chronological modelling, but in South Wales and the Marches at least it seems to begin in the 34th or 33rd centuries cal BC (Fig. 11.19). Later still, around and after 3000 cal BC (Fig. 14.145), long barrows and long cairns, what we have defined as diverse and small monuments, and cursus monuments, all went out of primary use: the final demise of practices of by now varying antiquity.

14.7 The early Neolithic of Ireland, the Isle of Man and Scotland: a comparative framework

We can now begin to draw more strands together to contribute to a wider narrative still. First, we will compare our date estimates for enclosure construction in southern Britain with those for Magheraboy and Donegore in Ireland. Then we will summarise the models which we presented in Chapter 12 for the start and development of the early Neolithic in Ireland. Any reader happening to begin at this point in Chapter 14 is strongly advised to consult Chapter 12 before proceeding! After that, we will present a brief survey of evidence from the Isle of Man and a sample of available evidence from Scotland south of the Great Glen, before finally offering our preferred outline of a linked narrative for all these areas.

Ireland: a reprise of the argument so far

Figure 14.146 shows our date estimates for the construction and abandonment of the causewayed enclosures at Magheraboy and Donegore, in comparison with our estimated dates for the construction of the first causewayed enclosure in southern Britain as a whole and for the abandonment of the last enclosure in that area. Our date estimate for the establishment of the Donegore enclosure is compatible with the time when enclosures first appeared in southern Britain, and the end of its primary use, around 3500 cal BC, falls comfortably within the southern British pattern. Magheraboy stands apart from these trends, on the basis of our preferred model probably being built in the 40th century cal BC (Fig. 12.15). An alternative model presented in Chapter 12 pulls the site a little later, perhaps suggesting a construction date in the 39th century cal BC (Fig. 12.17), but as, argued there, that requires special pleading and is inconsistent with the criteria otherwise employed throughout this project; it also leaves Magheraboy in western Ireland out on its own as the earliest dated enclosure in the whole of Britain and Ireland. We can note that the end of Magheraboy's primary use does fit wider patterns, and that features within its interior date significantly later than the initiation of its enclosure ditch.

The matter does not have to be settled only within the bounds of Britain and Ireland. We will discuss wider European chronologies for the development of enclosures in Chapter 15, where the evidence for a range of ditched and palisaded constructions dated to before 4000 cal BC will be considered, which could have been the antecedents for the form of practice materialised at Magheraboy.

Whereas Donegore was discussed in its local and regional settings, in the same way that southern British enclosures were considered in the regional chapters, site by site, in the case of Magheraboy, the early estimate for its establishment necessitated a much wider review of the date for the early Neolithic in Ireland as a whole. Chapter 12.3 has set out a wide range of other evidence for early Neolithic things and practices in Ireland: rectangular timber houses, other occupations, domesticated fauna, the field systems at Céide Fields and elsewhere, court tombs, portal tombs, and other monuments (and, to constrain the end of the early Neolithic, we have considered the available dating evidence for Linkardstown burials and passage tombs, including the Mound of the Hostages, Tara).

We presented three alternative models for the chronology of the early Neolithic in Ireland, all excluding dates from the Donegore and Magheraboy enclosures. The first, which includes the assumption that court tombs and portal tombs belonged only within the early Neolithic, has very poor agreement and must be set aside. The second treats several elements of the model including court tombs, portal

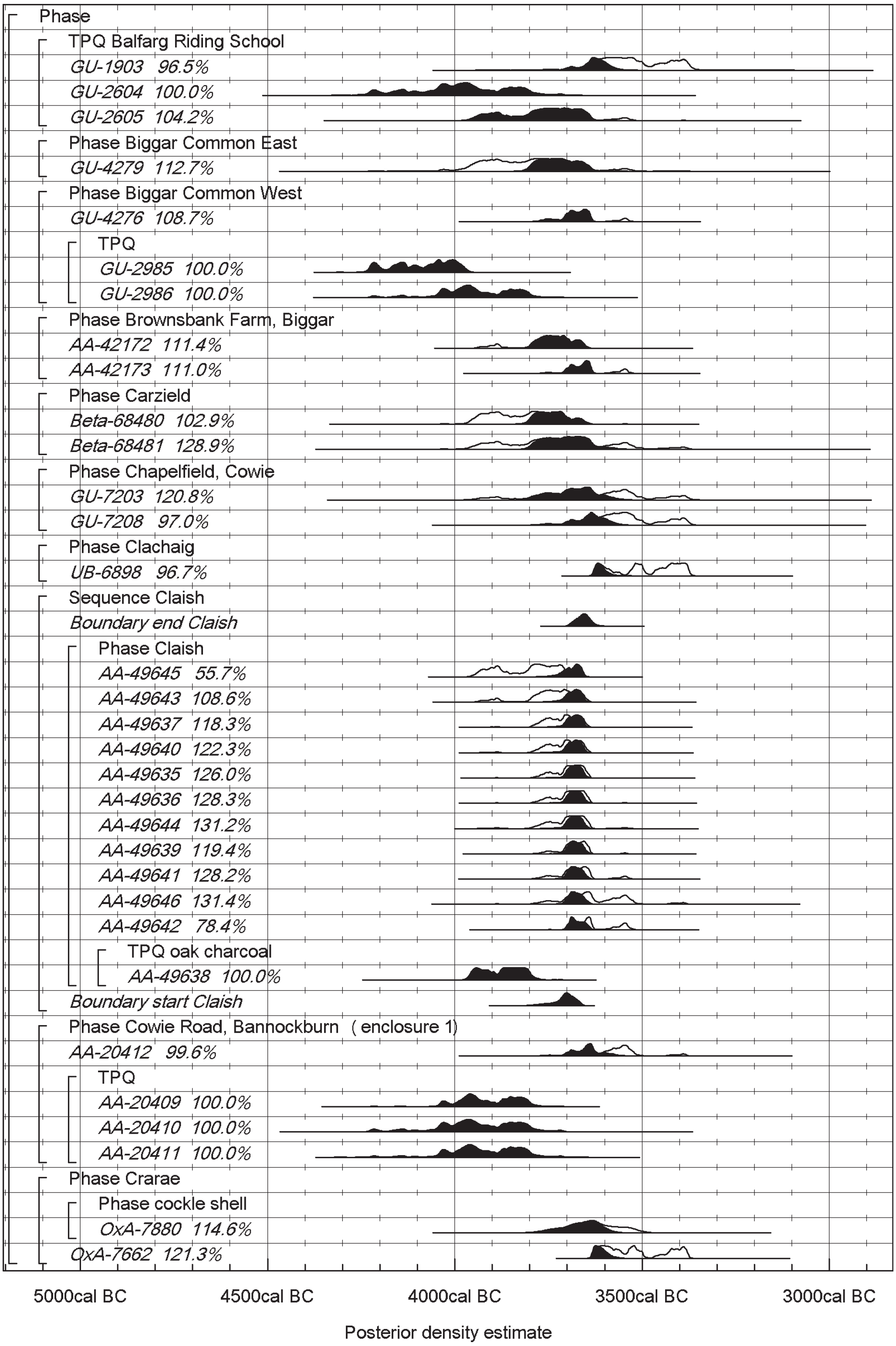


Fig. 14.151. Probability distributions of dates for early Neolithic activity in southern Scotland. The format is identical to that for Fig. 14.1. The overall structure of this model is shown in Fig. 14.150, and its other components in Figs 14.152–3.

tombs and domesticates simply as *termini ante quos* for the start of the early Neolithic, with only houses and other occupation in a uniformly distributed period of activity before the appearance of Linkardstown burials and passage tombs. In variants of the model, the removal of outlying dates for domesticates, including OxA-3869 from Ferriter's Cove, produced a date estimate for the start of the early Neolithic in Ireland in the later 38th century cal BC (Figs 12.54–5, 12.57). The third model puts all these elements (but excluding domesticates) within a single uniformly

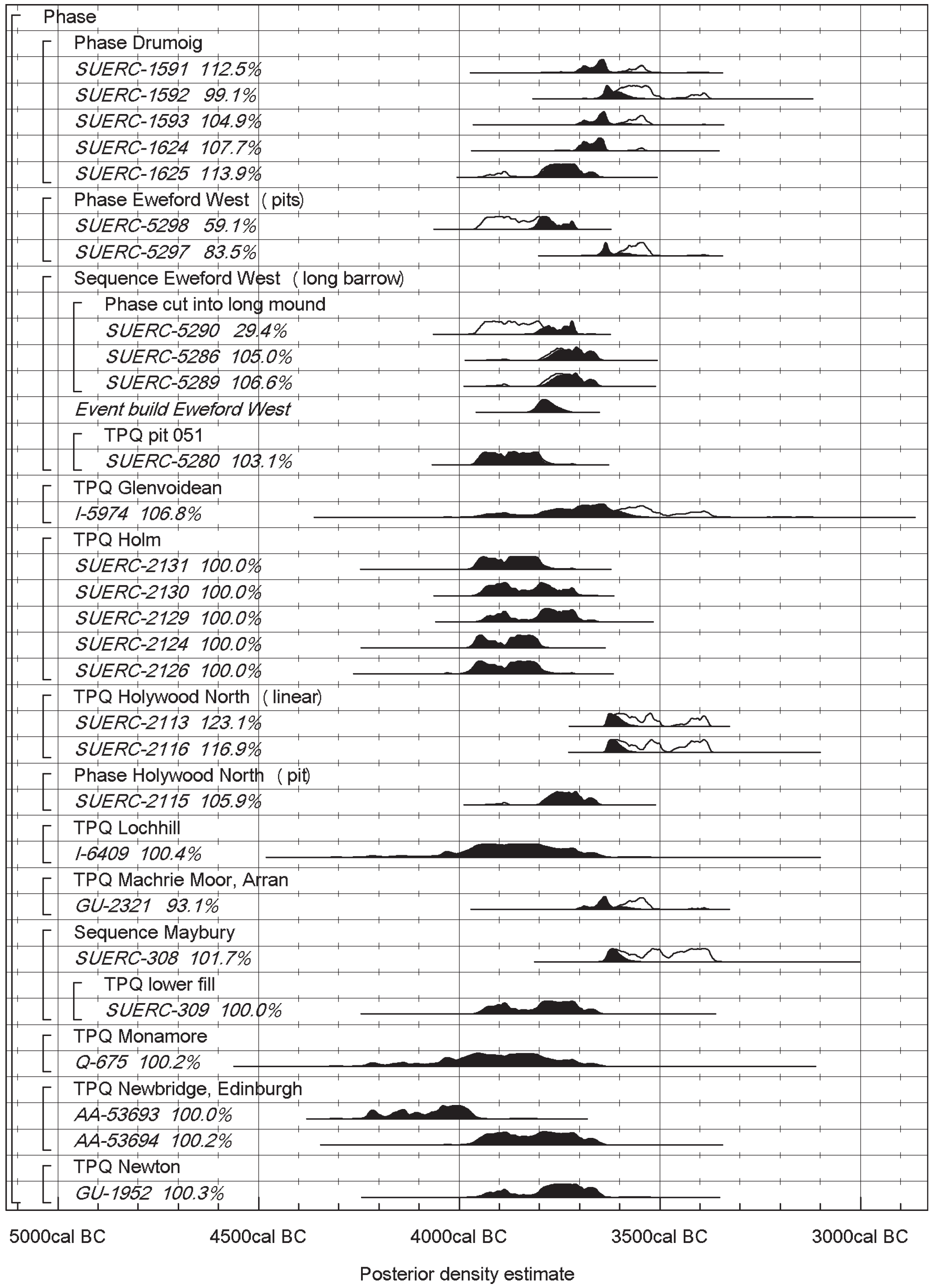


Fig. 14.152. Probability distributions of dates for early Neolithic activity in southern Scotland. The format is identical to that for Fig. 14.1. The overall structure of this model is shown in Fig. 14.150, and its other components in Figs 14.151 and 14.153.

distributed period of activity covering both the early, and selected elements of the middle, Neolithic in Ireland (incorporating again a sequence from rectangular houses and other early Neolithic occupation to Linkardstown burials to passage tombs; Figs 12.56–7). This produces a significantly earlier date estimate for the start of the early Neolithic in Ireland – in the earlier 38th century cal BC. Both of these models produce date estimates for the start of the Neolithic in Ireland that are significantly later than our estimate for the date at which Magheraboy was constructed.

Figure 14.147 provides a summary for the dates of different elements of the Irish Neolithic derived from the models described in Chapter 12. As things stand, and without special pleading, the enclosure at Magheraboy is stubbornly 200 years earlier than any other feature of the

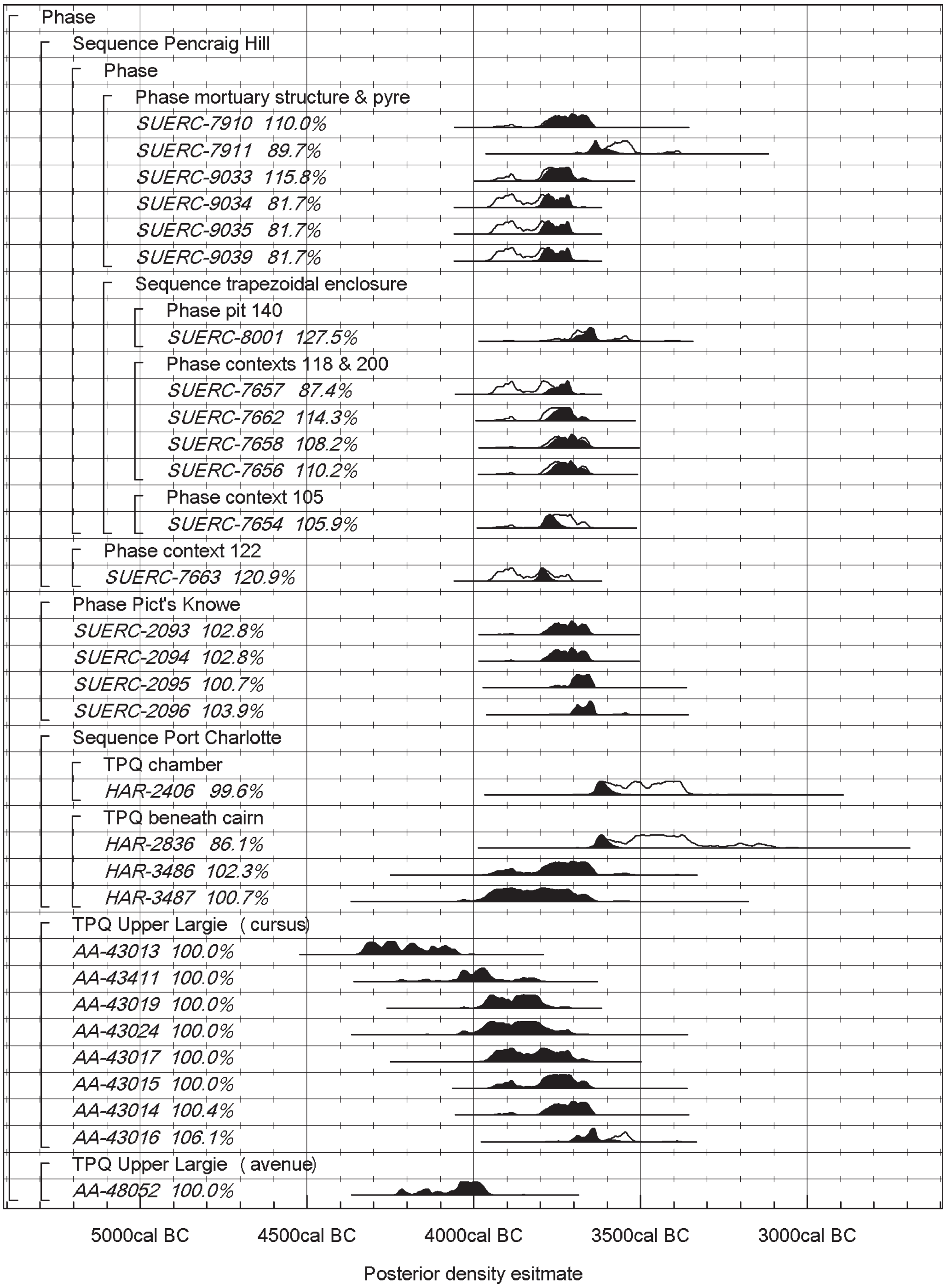


Fig. 14.153. Probability distributions of dates for early Neolithic activity in southern Scotland. The format is identical to that for Fig. 14.1. The overall structure of this model is shown in Fig. 14.150, and its other components in Figs 14.151–2.

early Neolithic so far reliably dated in Ireland. Various compromise options are discussed in Chapter 12, but none is convincing, and resolving this fundamental problem must be a priority for further research. Notwithstanding this issue, our analysis of the chronology of the early Neolithic in Ireland has highlighted some interesting trends. There is no compelling evidence that any other monument in Ireland was constructed before the second quarter of the fourth millennium cal BC, although the available dating evidence is of limited utility (Figs 12.31 and 12.35–6). The Céide field systems belong probably to the earlier to mid- fourth millennium cal BC, but not any earlier (Fig. 12.40). The rectangular houses stand out as belonging to a period of a century or less, in the late 38th into the later 37th century cal BC (Figs 12.28–9), rather later than the scarcer, larger Scottish halls, which began to be built in the earlier 38th century cal BC (Fig. 14.173). Depending on whether one favours model 3 or model 2, houses may have been a slightly later development within the start of the early Neolithic in Ireland or an integral feature of its

very initiation respectively. In either model, we get a sense of the rapid tempo of development in Ireland. Our dating review was not able, however, to cover axehead production or the development of material networks in the way that was possible for southern Britain, and so our models are in this sense more limited. Nonetheless, unless further research manages to fill convincingly the gap between our current estimate for the construction date of the Magheraboy enclosure and the dates of other early Neolithic things and practices in Ireland, our date estimates as a whole suggest that the pace of Neolithisation in Ireland was swift – potentially court tombs, enclosures and other types of monuments, houses and other occupation, various forms of Bowl pottery, and cereals could all have appeared during the 38th century cal BC. On the basis of the published evidence, we do not find the suggestion that simple passage tombs may belong to the early years of the Neolithic in Ireland convincing (Sheridan 2003b; Sheridan *et al.* 2008; Pailler and Sheridan 2009). Uncertainty as to the original form of the disturbed monument at Broadsands in Devon, built in the later thirty-ninth or earlier thirty-eighth century cal BC (Fig. 10.30), reduces its worth as ammunition in this argument. Domesticated fauna may indicate sporadic contact with continental Europe from rather earlier, perhaps as early as the third quarter of the fifth millennium cal BC (Fig 12.43: *OxA-3869*).

The Isle of Man and Scotland south of the Great Glen

To consider the place of enclosures on an even wider basis, we will next bring in the Isle of Man and part of Scotland. This is obviously a selective exercise, since we have not been able to cover either north Wales or the rest of England in this study. Models for the chronology of the early Neolithic in the English Midlands (thus more or less coinciding with the northernmost distribution of causewayed enclosures in southern Britain) and the north of England, drawing on the existing corpus of radiocarbon dates, are currently being constructed by Seren Griffiths.[8] There is also currently fresh research on north Wales, led by the National Museum of Wales (Steve Burrow, pers. comm.), and there have been relevant contract archaeology projects near Bangor (e.g. Kenney 2009) and on Anglesey in recent times, among other examples. This is a substantial area of Britain as a whole to leave out of the current analysis, but it is beyond the remit of the current project, and we must be pragmatic and patient.

The Isle of Man. Lying in the middle of the northern part of the Irish Sea, the Isle of Man is of potentially great significance in the spread of Neolithic things and practices into western Britain and Ireland. There is so far, however, regrettably little that can be said about the chronology of the early Neolithic on Mann. None of the chambered tombs, discussed recently by Chris Fowler (2001; 2002), have radiocarbon evidence. The only relevant date in the list provided by Chiverrell *et al*. (1999) is OxA-2481 (4970±80 BP), on a marine limpet shell which calibrates to 3630–3070 cal BC (95% confidence) using the marine calibration dataset of Hughen *et al.* (2004) and a ΔR value of 5±40BP (Stuiver and Braziunas 1993). This sample was allegedly from below a cist at Port St Mary, on the southern end of the island, which contained human bone perhaps from three individuals (Swinnerton 1889). The court tombs of Cashtal yn Ard and King Orry's Grave point to communication with Ireland and south-west Scotland, as do the form and decoration of the local variant of Bowl pottery (Burrow 1997, 11–16; cf. Cooney 200a; Cummings 2009). From the north end of the island, the presence of cereal-type pollen has been claimed as far back as the start of Zone C in the pollen diagram from Ballachrink, radiocarbon dated to 4950–4680 cal BC (95% confidence; 5925±60 BP; AA-29337; Innes *et al*. 2003). Although other sites are mapped from around the Irish Sea (and beyond) with cereal-type pollen radiocarbon dated to the first half of the fifth millennium cal BC (Innes *et al*. 2003, fig. 1), including Machrie Moor on Arran (Robinson and Dickson 1988), the suggestion that this evidence relates to the cultivation of cereals presents considerable problems. It relies on the identification of 'cereal-type' pollen as indeed of cereal taxa, and the belief that there has been no contamination or stratigraphic intrusion in a particular location. At Ballachrink it seems that it is the identification of 'cereal-type' pollen with domesticated cereals that must be in error, as such pollen was found at several levels in the diagram and formed a coherent pollen zone (Innes *et al*. 2003, fig. 3). These instances of 'cereal-type' pollen are significantly earlier than any other indication of changed practice across the whole of Britain and Ireland, and so, for the present, it seems to us prudent not to accept such uncertain indications of cultivation in the face of the weight of other, more certain, strands of evidence.

That leaves the dating evidence from Billown itself, presented in Chapter 11. We have taken dates associated with diagnostic early Neolithic material and those on cereal grains themselves to suggest a period of early Neolithic activity at Billown. This began in *4040–3700 cal BC* (*95% probability*; Fig. 14.148: *start Manx Neolithic*), probably in *3905–3725 cal BC* (*68% probability*). This estimate is imprecise, because it based on very little evidence, our earliest dated samples probably falling in the 38th or 37th century cal BC. This period of activity on the site ended in *3240–2850 cal BC* (*95% probability*; Fig. 14.148: *end Manx Neolithic*), probably in *3170–2950 cal BC* (*68% probability*). Further dating of short-life material firmly associated with early Neolithic activity on Mann is obviously highly desirable.

Scotland south of the Great Glen. To complete our wider (but selective) sample of radiocarbon evidence for the start of the Neolithic in Britain and Ireland, we have gathered dates for the early Neolithic in Scotland south of the Great Glen. We have utilised the Historic Scotland database of radiocarbon dates (http://www.historic-scotland.gov.uk/index/heritage/archaeology/archaeology-techniques/radiocarbon-dating/), the datelist for northern Carinated Bowl given by Alison Sheridan (2007a, with references),

Table 14.14. Radiocarbon dates from sites in Scotland south of the Great Glen associated with diagnostic early Neolithic activity.

Laboratory Number	Description	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*	References
Southern Scotland						
Balfarg Riding School, Fife						
GU-1903	Alder, hazel and ash charcoal from Context 8019B of Pit 8016 with plain Neolithic pottery bowls, of modified Carinated style	4765±85	−24.8	3710–3360	*3760–3740* (*1%*) or *3715–3550* (*94%*)	Barclay and Russell-White 1993, 160–1; Cowie 1993
GU-2604	Hazel, oak and willow charcoal from Context 8019B of Pit 8016 with plain Neolithic pottery, of modified Carinated style	5170±90	−25.4	4240–3770	*4240–3765*	Barclay and Russell-White 1993, 160–1; Cowie 1993
GU-2605	Oak charcoal from Context 8019B of Pit 8016 with plain Neolithic pottery bowls, of modified Carinated style	4950±90	−25.2	3960–3530	*3950–3635*	Barclay and Russell-White 1993, 160–1; Cowie 1993
Biggar Common (aka Biggar Common West), South Lanarkshire						
GU-4276	Hazel roundwood charcoal with small quantities of oak and alder charcoal from Sample Area 5,l from a charcoal spread (105) in an isolated spot with a concentration of Carinated Bowl sherds mixed with charcoal; possibly a food preparation area	4880±50		3770–3530	*3775–3630*	D.E. Johnston 1997, 240–3; Sheridan 2007a
GU-2985	Oak, hazel, birch and willow charcoal from a bonfire immediately under a non-megalithic long barrow with Carinated Bowl pottery and flint and chert artefacts	5250±50	−25.5	4240–3960	*4235–4190* (*13%*) or *4180–3965* (*82%*)	D.E. Johnston 1997, 240–3; Sheridan 2007a
GU-2986	Oak, hazel, and birch from a bonfire immediately under a non-megalithic long barrow with Carinated Bowl pottery and flint and chert artefacts	5150±70	−25.3	4230–3780	*4230–4200* (*2%*) or *4170–4125* (*3%*) or *4080–3770* (*90%*)	D.E. Johnston 1997, 240–3; Sheridan 2007a
Brownsbank Farm, Biggar, South Lanarkshire						
AA-42172	Single piece of hazel charcoal from pit (Feature 1), associated with Carinated Bowl pottery	4960±45	−25.9	3930–3640	*3795–3655*	Sheridan 2007a
AA-42173	Single piece of hazel charcoal from a second pit (Feature 2), associated with Carinated Bowl pottery	4865±45	−26.2	3710–3530	*3770–3625*	Sheridan 2007a
Carwood Hill (aka Biggar Common East), Biggar, South Lanarkshire						
GU-4279	Hazel charcoal from a spread of dense charcoal (103) in Area 2, near to shallow pits and containing large quantities of hazel kernel and early Neolithic pot sherds, probably Carinated Bowl. Deposition of carbonised material with kernels indicates an area of food processing, possibly associated with a fire and cooking	4990±110		4040–3530	*3810–3630*	Biggar Museum Trust 1993; Sheridan in D.E. Johnston 1997, 220; Sheridan 2007a
Carzield, Dumfries and Galloway						
Beta-68480	Bulk charcoal of mixed short-life species from a pit with Carinated Bowl pottery and cereal grains	5010±70		3970–3640	*3805–3655*	Sheridan 2007a; Brophy 2006
Beta-68481	Bulk charcoal of mixed short-life species from a pit with Carinated Bowl pottery and cereal grains	4920±110		3970–3380	*3805–3595*	Sheridan 2007a; Brophy 2006

Laboratory Number	Description	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*	References
Chapelfield, Cowie, Stirling						
GU-7203	Bulk sample hazel charcoal from the final fill (350) of pit VII containing Carinated Bowl pottery. See GU-7208 from the basal fill	4860±100	−25.9	3940–3370	*3795–3580*	J. Atkinson 2002
GU-7208	Bulk sample hazel charcoal from a charcoal-rich layer forming the basal fill (440) of pit VII	4800±80	−26.0	3710–3370	*3765–3720* (*5%*) or *3715–3560* (*90%*)	J. Atkinson 2002
Clachaig, Arran, North Ayrshire						
UB-6898	Unburnt human cranium (sample D^2) from Clyde cairn	4708±37	−22.0	3640–3370	*3635–3575*	Sheridan 2006b
UB-6897	Unburnt human cranium (sample C) from Clyde cairn. Excluded from models	3949±363	−21.0	3500–1490		Sheridan 2006b
Claish, Stirling						
AA-49645	Hazel charcoal bulk sample from post-pipe of post F30 in internal line 4, part of screen V, of timber hall. There is Carinated Bowl pottery in the timber hall as a whole	5000±50	−26.7	3960–3650	*3745–3650*	G. Barclay *et al.* 2002; Sheridan 2007a
AA-49643	Hazelnut shell bulk sample from layer of probably *in situ* burning in pit F19 within space C of timber hall	4950±50	−24.9	3930–3640	*3735–3645*	G. Barclay *et al.* 2002; Sheridan 2007a
AA-49637	Single hazelnut shell from F13, post of internal line 1 at end of screen (II) in timber hall	4935±40	−23.2	3800–3640	*3730–3645*	G. Barclay *et al.* 2002; Sheridan 2007a
AA-49640	Birch charcoal bulk sample from layer of *in situ* burning in pit F15 within space C of timber hall	4930±40	−26.0	3800–3640	*3730–3645*	G. Barclay *et al.* 2002; Sheridan 2007a
AA-49635	Hazelnut shell bulk sample from postpipe fill of F9, post in E wall of timber hall	4915±40	−28.3	3780–3630	*3720–3640*	G. Barclay *et al.* 2002; Sheridan 2007a
AA-49636	Hazelnut shell bulk sample from postpipe fill of F8, post in E wall of timber hall	4910±45	−22.5	3790–3630	*3720–3640*	G. Barclay *et al.* 2002; Sheridan 2007a
AA-49644	Hazelnut shell bulk sample from mid-fill of post F21 at N end of timber hall	4910±50	−25.0	3800–3630	*3720–3640*	G. Barclay *et al.* 2002; Sheridan 2007a
AA-49639	Hazelnut shell bulk sample from layer of *in situ* burning in pit F15 within space C of timber hall	4895±40	−24.0	3770–3630	*3710–3640*	G. Barclay *et al.* 2002; Sheridan 2007a
AA-49641	Emmer grain bulk sample from layer of *in situ* burning in pit F15 within space C of timber hall	4885±50	−25.0	3780–3530	*3715–3640*	G. Barclay *et al.* 2002; Sheridan 2007a
AA-49646	Hazelnut shell bulk sample from post-pipe of post F37, possibly secondary, in N wall of timber hall	4855±70	−27.1	3780–3380	*3715–3635*	G. Barclay *et al.* 2002; Sheridan 2007a
AA-49642	Hazelnut shell bulk sample from layer of probably *in situ* burning in pit F19 within space C	4845±40	−25.2	3710–3530	*3705–3635*	G. Barclay *et al.* 2002; Sheridan 2007a
AA-49638	Oak charcoal (?burnt stake) from F14, slot for screen II of timber hall	5080±40	−25.2	3970–3770	*3970–3785*	G. Barclay *et al.* 2002; Sheridan 2007a
Cowie Road, Bannockburn, Stirling						
AA-20412	Hazel charcoal from phase 2 fill of pit P25 of a pit-defined long mortuary enclosure Enclosure 1), 33 to 36m across with a rounded end, associated with Carinated Bowl pottery	4830±60		3710–3380	*3760–3740* (*2%*) or *3715–3555* (*93%*)	Rideout 1997, 37, 52–3; Sheridan 2007a

Laboratory Number	Description	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*	References
AA-20409	Oak charcoal from the lower charcoal fill of pit P6 of a pit-defined long mortuary enclosure (Enclosure 1), 33 to 36 m across with a rounded end, associated with Carinated Bowl pottery	5130±60		4050–3780	*4050–3775*	Rideout 1997, 37, 52–3; Sheridan 2007a
AA-20410	Oak charcoal from the lower charcoal fill of pit P6 of a pit-defined long mortuary enclosure (Enclosure 1), 33 to 36 m across with a rounded end, associated with Carinated Bowl pottery	5145±80		4230–3760	*4230–4200* (*2%*) or *4170–4125* (*4%*) or *4120–4095* (*1%*) or *4080–3755* (*88%*)	Rideout 1997, 37, 52–3; Sheridan 2007a
AA-20411	Oak charcoal from the lower charcoal fill of pit P6 of a pit-defined long mortuary enclosure (Enclosure 1), 33 to 36 m across with a rounded end, associated with Carinated Bowl pottery	5135±70		4050–3770	*4160–4130* (*1%*) or *4065–3755* (*94%*)	Rideout 1997, 37, 52–3; Sheridan 2007a
Crarae, Argyll and Bute						
OxA-7662	Human phalanx from NN 1186.2, part of a small group of human bones and teeth at the east end of the middle segment of the burial chamber	4735±40	−21.5	3640–3370	*3640–3570*	Ashmore 2000; Schulting and Richards 2002b
OxA-7880	Cockle shell from sample NN 1161 which may refer to the construction/initial use phase of the monument. OxA-7880 Part of a large group of shells in the burial chamber, interpreted by the excavator as probably a foundation deposit	5230±55		3780–3490[1]	*3775–3575*	Ashmore 2000; Schulting and Richards 2002b
Drumoig, Cowbakie Hill and Craigie Hill, Fife						
SUERC-1591	Hazel charcoal from circular pit 171 associated with Carinated Bowl pottery	4850±45	−25.3	3710–3520	*3760–3740* (*1%*) or *3715–3615* (*89%*) or *3610–3560* (*5%*)	Sheridan 2007a
SUERC-1592	Hazel charcoal from pit 176 associated with Carinated Bowl pottery	4775±45	−24.2	3650–3370	*3655–3560*	Sheridan 2007a
SUERC-1593	Hazelnut shell from circular feature 178 associated with Carinated Bowl pottery and leaf arrowhead	4835±45	−25.2	3710–3520	*3710–3560*	Sheridan 2007a
SUERC-1624	Hazel charcoal from probable cooking pit 2603 associated with Carinated Bowl pottery	4870±40	−25.8	3710–3530	*3760–3740* (*2%*) or *3715–3625* (*93%*)	Sheridan 2007a
SUERC-1625	Alder charcoal from shallow pit 2613 associated with Carinated Bowl pottery	4975±40	−25.8	3940–3650	*3800–3690* (*87%*) or *3685–3660* (*8%*)	Sheridan 2007a
Dunragit, Dumfries and Galloway						
SUERC-2103	Hazel charcoal believed to be associated with burning of oak post in cursus	4890±35		3720–3630		Sheridan 2007a
Eweford West, East Lothian						
SUERC-5290	Hazel charcoal from stakehole 216 on second mound phase of monument that ends as a non-megalithic long barrow/mortuary enclosure. Carinated Bowl pottery associated with this activity	5055±35	−25.2	3960–3710	*3805–3705*	Sheridan 2007a; Lelong and MacGregor 2007

Laboratory Number	Description	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*	References
SUERC-5286	Alder charcoal from burnt timber screen set in trench 171 on second mound phase of monument that ends as a non-megalithic long barrow. Carinated Bowl pottery associated with this phase of activity	4950±35	−26.6	3800–3650	*3780–3650*	Sheridan 2007a; Lelong and MacGregor 2007
SUERC-5289	Hazel charcoal from stakehole 209 to W of timber screen on second mound phase of monument that ends as a non-megalithic long barrow. Carinated Bowl pottery associated with these activities	4960±35	−26.7	3900–3650	*3780–3655*	Sheridan 2007a; Lelong and MacGregor 2007
SUERC-5280	Cattle radius in large pit, no pottery; cut into first small mound of monument that ends as a non-megalithic long barrow	5065±35	−22.0	3970–3770	*3955–3795*	Sheridan 2007a; Lelong and MacGregor 2007
SUERC-5298	*Corylus* charcoal from pit 025, which contained Carinated Bowl pottery	5045±35	−26.70	3960–3710	*3815–3710*	Sheridan 2007a; Lelong and MacGregor 2007
SUERC-5297	*Corylus* charcoal from pit 019, which contained modified Carinated Bowl pottery	4800±35	−24.10	3660–3520	*3655–3555*	Lelong and MacGregor 2007
Glenvoidean, Bute, Argyll and Bute						
I-5974	Charcoal under the west slab of the main chamber	4860±115		3950–3360	*3945–3830* (*13%*) or *3825–3570* (*82%*)	Marshall and Taylor 1979
Holm, Dumfries and Galloway						
SUERC-2131	Oak charcoal 069 from *in situ* post in fill 198 of post-hole 115 of the post cursus. First of three posts within this posthole	5075±40	−24.8	3970–3770	*3965–3780*	Thomas 2007b; Sheridan 2007a
SUERC-2130	Oak charcoal 067 (Bag 2) from *in situ* post in fill 227 of post-hole 115 of the cursus. Third of three posts within this posthole	5025±40	−24.5	3960–3700	*3945–3710*	Thomas 2007b; Sheridan 2007a
SUERC-2129	Oak charcoal 067 (Bag 1) from same *in situ* post in fill 227 of post-hole 115 of the post cursus. Third of three posts within this posthole	5000±40	−25.5	3950–3660	*3945–3690*	Thomas 2007b; Sheridan 2007a
SUERC-2124	Oak charcoal 026 sealed in fill 073 of post-hole 075 of the post cursus	5095±35	−27.4	3980–3790	*3970–3890* (*38%*) or *3885–3795* (*57%*)	Thomas 2007b; Sheridan 2007a
SUERC-2126	Oak charcoal 030 sealed in fill 073 of post-hole 075 of the post cursus	5095±50	−25.6	3990–3770	*3990–3770*	Thomas 2007b; Sheridan 2007a
Holywood North, Dumfries and Galloway						
SUERC-2113	Oak charcoal 02 from fill 014 of post-hole 015 of post setting within ditch-defined cursus, cutting that for the large postpit 224 dated by SUERC-2116	4740±35	−26.2	3640–3370	*3640–3570*	Thomas 2007b; Sheridan 2007a
SUERC-2116	Oak charcoal 15 from layer 053 of large postpit 224 pre-dating cursus construction	4725±40	−25.1	3640–3370	*3640–3570*	Thomas 2007b; Sheridan 2007a
SUERC-2115	Hazelnut shell 09 in fill 135 of feature 102 within ditch-defined cursus, perhaps second of two postfills. Carinated Bowl pottery in lower and side fill of posthole	4960±35	−25.0	3900–3650	*3790–3655*	Thomas 2007b; Sheridan 2007a
Lochhill, Dumfries and Galloway						
I-6409	Wood from a plank from a mortuary structure under a chambered cairn. (Pot 'almost certainly' traditional Carinated Bowl: Sheridan 2007a, 491)	5070±105		4060–3640	*4055–3640*	Masters 1973

Laboratory Number	Description	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*	References
Machrie Moor, Arran, North Ayrshire						
GU-2321	Mixed charcoal from pits with parts of six plain Neolithic pots including Carinated Bowls	4820±50	−25.5	3700–3510	*3710–3560*	Haggarty 1991
Maybury Business Park (Areas B and C), City of Edinburgh						
SUERC-308	Hazelnut shell from context 649 in upper fill of pit in Area B, with two sherds of Carinated Bowl pottery. Sheridan notes that sherds from Area B are small and it is not possible to be certain whether they represent 'traditional' Carinated Bowl pottery or 'modified Carinated Bowl'. The Area C pottery is 'traditional Carinated Bowl'	4710±55	−24.55	3640–3360	*3640–3565*	Sheridan 2007a
SUERC-309	Piece of hazel roundwood charcoal from primary fill 671 of same pit in Area B as provided SUERC-308 from context 649	4995±55	−25.57	3960–3650	*3945–3655*	Sheridan 2007a
Monamore, Arran, North Ayrshire						
Q-675	Charcoal from a hearth in the forecourt under the blocking of a chambered cairn	5110±110		4230–3650	*4230–4195* (*2%*) or *4170–4125* (*3%*) or *4120–4090* (*2%*) or *4080–3655* (*88%*)	MacKie 1966
Q-676	Charcoal from the top of a thick layer of deposits in the forecourt of a chambered cairn	4190±110		3080–2470		MacKie 1966
Newbridge, City of Edinburgh						
AA-53693	Oak charcoal possibly from post; Carinated Bowl pottery in fill of same feature	5235±55	−25.0	4240–3950	*4235–4185* (*11%*) or *4180–3955* (*84%*)	Sheridan 2007a
AA-53694	Oak charcoal possibly from post; Carinated Bowl pottery in fill of same	5010±75	−24.9	3970–3640	*3960–3655*	Sheridan 2007a
Newton, Islay, Argyll and Bute						
GU-1952	Alder, hazel and oak charcoal from Pit F3, a small pit with Carinated Bowl pottery, cut by possible fence lines, which were in turn earlier than pit F4 dated by GU-1951	4965±60	−27.4	3950–3640	*3945–3855* (*18%*) or *3820–3640* (*77%*)	Sheridan 2007a
Pencraig Hill, East Lothian						
SUERC-7910	Bone apatite from cremated human bone from fresh bodies burnt on pyre within mortuary structure of trapezoidal post-defined mortuary enclosure	4940±50	−27.9	3910–3630	*3785–3645*	Sheridan 2007a; Lelong and MacGregor 2007
SUERC-7911	Bone apatite from cremated human bone from fresh bodies burnt on pyre within mortuary structure of trapezoidal post-defined mortuary enclosure	4800±50	−27.7	3660–3380	*3695–3560*	Sheridan 2007a; Lelong and MacGregor 2007
SUERC-9033	Oak bark from collapsed pyre within mortuary structure of trapezoidal post-defined mortuary enclosure	4985±35	−28.0	3940–3660	*3800–3690* (*93%*) or *3680–3665* (*2%*)	Lelong and MacGregor 2007
SUERC-9034	Oak bark from collapsed pyre within mortuary structure of trapezoidal post-defined mortuary enclosure	5025±35	−29.2	3950–3700	*3800–3705*	Lelong and MacGregor 2007
SUERC-9035	Oak bark from collapsed pyre within mortuary structure of trapezoidal post-defined mortuary enclosure	5025±35	−28.0	3950–3700	*3800–3705*	Lelong and MacGregor 2007

Laboratory Number	**Description**	**Radiocarbon Age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC) (95% probability)***	**References**
SUERC-9039	Oak bark from collapsed pyre within mortuary structure of trapezoidal post-defined mortuary enclosure	5025±35	−27.6	3950–3700	*3800–3705*	Lelong and MacGregor 2007
SUERC-8001	Hazel charcoal from N pit 140 at E end of N side of trapezoidal post-defined mortuary enclosure. Pit cuts E façade 114	4870±50	−25.1	3760–3530	*3715–3620* (*94%*) or *3590–3570* (*1%*)	Sheridan 2007a; Lelong and MacGregor 2007
SUERC-7657	Alder charcoal from basal fill 178 of corner posthole at junction of E façade and S long side of trapezoidal post-defined mortuary enclosure.	5015±35	−25.6	3950–3700	*3790–3700*	Sheridan 2007a; Lelong and MacGregor 2007
SUERC-7662	Alder charcoal from main fill 113 of E façade 114 of trapezoidal post-defined mortuary enclosure	4975±35	−25.1	3910–3650	*3780–3690* (*90%*) or *3685–3660* (*5%*)	Sheridan 2007a; Lelong and MacGregor 2007
SUERC-7658	Alder charcoal from main fill 113 of E façade 114 of trapezoidal post-defined mortuary enclosure	4945±35	−24.5	3800–3640	*3770–3655*	Sheridan 2007a; Lelong and MacGregor 2007
SUERC-7656	Hazel charcoal fragment from slot 199 behind of E façade 114 of trapezoidal post-defined mortuary enclosure	4955±35	−24.4	3800–3650	*3775–3660*	Sheridan 2007a; Lelong and MacGregor 2007
SUERC-7654	Hazel charcoal from main fill 105 of trench forming N side of trapezoidal post-defined mortuary enclosure. Carinated Bowl pottery and barley grains from this fill	4965±35	−27.8	3900–3650	*3800–3730*	Sheridan 2007a; Lelong and MacGregor 2007
SUERC-7663	Alder charcoal from rakeout of fire within possible structure on first phase of monument that ends as trapezoidal post-defined mortuary enclosure. No pottery in this phase	5025±35	−24.3	3950–3700	*3820–3755*	Sheridan 2007a; Lelong and MacGregor 2007
SUERC-7655	Alder charcoal from main fill 105 of trench forming N side of trapezoidal post-defined mortuary enclosure. Carinated Bowl pottery and barley grains from this fill	3835±35	−25.7	2470–2140		Sheridan 2007a; Lelong and MacGregor 2007
Pict's Knowe, Dumfries and Galloway						
SUERC-2093	Alder charcoal 2687 in fill of pit 6270 with Carinated Bowl pottery	4945±35	−26.9	3800–3640	*3785–3650*	Thomas 2007b; Sheridan 2007a
SUERC-2094	Alder charcoal 2491 in fill of a second pit 6471 with Carinated Bowl pottery	4945±35	−28.2	3800–3640	*3785–3650*	Thomas 2007b; Sheridan 2007a
SUERC-2095	Charred hazelnut shell 2655 (date 1) in fill of a third pit 6725 with Carinated Bowl pottery	4900±35	−24.4	3760–3630	*3765–3720* (*8%*) or *3715–3635* (*87%*)	Thomas 2007b; Sheridan 2007a
SUERC-2096	Hazel charcoal 2655 (date 2) in fill of a third pit 6725 with Carinated Bowl pottery	4875±35	−26.1	3710–3630	*3715–3630*	Thomas 2007b; Sheridan 2007a
Port Charlotte, Islay, Argyll and Bute						
HAR-2406	Charcoal from the chamber of Clyde chambered cairn. Sherds from 5 plain pots in the monument, but type not identified	4710±70		3650–3350	*3655–3560*	Sheridan 2007a
HAR-2836	Carbonised hazel nutshells and short-life species charcoal from occupation layer (PC78M104), with animal bones and flints under Clyde chambered cairn	4660±90	−25.2	3650–3100	*3660–3555*	Sheridan 2007a

Laboratory Number	Description	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*	References
HAR-3486	Carbonised hazel nutshells and short-life species charcoal from occupation layer (PC79M405), with animal bones and flints under Clyde chambered cairn	4940±70	−26.4	3950–3630	*3945–3855* (*14%*) or *3820–3630* (*81%*)	Sheridan 2007a
HAR-3487	Carbonised hazel nutshells and short-life species charcoal from occupation layer (PC79M406), with animal bones and flints under Clyde chambered cairn	5020±90	−26.3	3990–3630	*3975–3645*	Sheridan 2007a
Upper Largie, Argyll and Bute						
AA-43013	Oak charcoal from post of cursus	5375±55		4350–4040	*4335–4050*	Sheridan 2007a
AA-43411	Oak charcoal from post of cursus	5175±55		4220–3800	*4230–4200* (*2%*) or *4165–4125* (*4%*) or *4075–3905* (*74%*) or *3880–3795* (*15%*)	Sheridan 2007a
AA-43019	Oak charcoal from post of cursus	5090±50		3990–3770	*3985–3765*	Sheridan 2007a
AA-43024	Oak charcoal from post of cursus	5090±75		4050–3700	*4040–4010* (*3%*) or *4005–3705* (*92%*)	Sheridan 2007a
AA-43017	Oak charcoal from post of cursus	5020±55		3970–3660	*3960–3695*	Sheridan 2007a
AA-43015	Oak charcoal from post of cursus	4975±50		3950–3650	*3945–3855* (*18%*) or *3815–3650* (*77%*)	Sheridan 2007a
AA-43014	Oak charcoal from post of cursus	4935±50		3900–3630	*3900-3875* (*2%*) or *3805–3635* (*93%*)	Sheridan 2007a
AA-43016	Oak charcoal from post of cursus	4840±50		3710–3520	*3715–3550*	Sheridan 2007a
AA-48052	Oak charcoal from post of avenue	5220±50		4230–3950	*4230–4195* (*7%*) or *4175–3950* (*88%*)	Sheridan 2007a
North-eastern Scotland						
Balbridie, Kincardine and Deeside						
OxA-1768	Flax from the destruction level of a timber hall associated with NE Carinated Bowl pottery	4940±70		3950–3630	*3790–3635*	Fairweather and Ralston 1993
OxA-1769	Crab apple from the destruction level of a timber hall associated with NE Carinated Bowl pottery	5010±90		3980–3630	*3815–3635*	Fairweather and Ralston 1993
OxA-1767	Oat grain from the destruction level of a timber hall associated with NE Carinated Bowl pottery	4820±80		3770–3370	*3780–3600*	Fairweather and Ralston 1993
GU-1828	Oak from the destruction level of a timber hall associated with NE Carinated Bowl pottery	5030±60	−24.9	3970–3660	*3960–3700*	Fairweather and Ralston 1993

Laboratory Number	Description	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*	References
GU-1829	Oak from the destruction level of a timber hall associated with NE Carinated Bowl pottery	4785±150	−25.2	3950–3100	*3955–3595*	Fairweather and Ralston 1993
GU-1830	Oak from the destruction level of a timber hall associated with NE Carinated Bowl pottery	4970±75	−25.9	3960–3630	*3945–3650*	Fairweather and Ralston 1993
GU-1831	Oak from the destruction level of a timber hall associated with NE Carinated Bowl pottery	5015±125	−26.4	4050–3530	*4055–3630*	Fairweather and Ralston 1993
GU-1832	Oak from the destruction level of a timber hall associated with NE Carinated Bowl pottery	4970±70	−25.8	3960–3630	*3945–3650*	Fairweather and Ralston 1993
GU-1035	Oak charcoal from the destruction level BB77 F8/C3 of a timber hall associated with NE Carinated Bowl pottery	4840±165	−25.6	3980–3120	*3990–3590*	Fairweather and Ralston 1993
GU-1036	Oak charcoal from the destruction level BB77 F1/C9 of a timber hall associated with NE Carinated Bowl pottery	4740±135	−25.2	3790–3090	*3945–3855* (*11%*) or *3825–3585* (*84%*)	Fairweather and Ralston 1993
GU-1037	Oak charcoal from the destruction level BB77 F1/C1 of a timber hall associated with NE Carinated Bowl pottery	4930±80	−25.7	3950–3530	*3945–3850* (*17%*) or *3845–3830* (*1%*) or *3825–3635* (*77%*)	Fairweather and Ralston 1993
GU-1038i	Oak from the destruction level BB77 F7/C6 of a timber hall associated with NE Carinated Bowl pottery	5160±100		4040–3700[ii]	*3990–3705*	Fairweather and Ralston 1993
GU-1038ii	Oak charcoal from the destruction level BB77 F7/C6 of a timber hall associated with NE Carinated Bowl pottery	5020±90	−26.5			Fairweather and Ralston 1993
GU-1421	Cereal grain bulk sample. No further contextual detail found	4745±160		3940–3020		G. Barclay *et al.* 2002
Boghead, Fochabers, Moray						
SRR-686	Charcoal from a black layer under NM round mound with much NE Carinated Bowl pottery	4898±60	−25.9	3800–3530	*3910–3875* (*2%*) or *3805–3625* (*93%*)	Burl 1984; Kinnes 1992b; G. Barclay *et al.* 2002; Noble 2006, 63
SRR-689	Charcoal from a black layer under burial mound with much NE Carinated Bowl pottery	4959±110	−28.5	3980–3520	*3980–3620*	Burl 1984; Kinnes 1992b; G. Barclay *et al.* 2002; Noble 2006, 63
SRR-683	Finely divided oak charcoal in sand infill of Pit 1 which was set in the old ground surface under the North Cairn	4950±180	−26	4230–3360	*4230–4200* (*1%*) or *4170–4125* (*1%*) or *4075–3565* (*93%*)	Burl 1984
SRR-684	Large fragments of oak from layer XIII, debris on the old ground surface under North Cairn	4823±60	−24.7	3710–3380	*3760–3740* (*1%*) or *3715–3540* (*94%*)	Burl 1984
SRR-685	Finely divided oak charcoal under sand filling working hollow M, one of 15 hollows under the Cairn	5031±100	−26.4	4040–3630	*3995–3640*	Burl 1984

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Castle Menzies, Home Farm, Perth and Kinross						
OxA-9813	Oak charcoal from post of long mortuary structure	5130±40		4040–3800	*4040–4020* (*3%*) or *3995–3890* (*51%*) or *3885–3795* (*41%*)	Sheridan 2007a
OxA-9987	Oak charcoal from post of long mortuary structure	5093±39		3980–3780	*3970–3795*	Sheridan 2007a
OxA-9816	Oak charcoal from post of long mortuary structure	5035±70		3980–3650	*3970–3690* (*94%*) or *3680–3665* (*1%*)	Sheridan 2007aa
OxA-9814	Oak charcoal from post of long mortuary structure	5010±40		3950–3690	*3945–3700*	Sheridan 2007a
Cleaven Dyke, Perth and Kinross						
GU-3911	Rotten oak charcoal in a small pit immediately underlying the bank of a bank barrow. See also GU-3912	5500±120	−26.6	4560–4040		Barclay and Maxwell 1998, 47
GU-3912	Rotten oak charcoal in a small pit immediately underlying the bank of a bank barrow. See also GU-3911	5550±130	−26.3	4690–4050		Barclay and Maxwell 1998, 47
Crathes, Warren Field, Aberdeenshire						
SUERC-4042	Short-life material. From timber hall, some from structural timbers, others from material sealed in pits or post holes. Structure as whole securely associated with Carinated Bowl pottery	5020±35		3950–3700	*3795–3705*	Sheridan 2007a
SUERC-4030	Short-life material. From timber hall, some from structural timbers, others from material sealed in pits or post holes	5005±35		3950–3700	*3790–3705*	Sheridan 2007a
SUERC-4043	Short-life material. From timber hall, some from structural timbers, others from material sealed in pits or post holes	4990±35		3940–3660	*3790–3705*	Sheridan 2007a
SUERC-4032	Short-life material. From timber hall, some from structural timbers, others from material sealed in pits or post holes	4990±40		3940–3660	*3790–3705*	Sheridan 2007a
SUERC-4038	Short-life material. From timber hall, some from structural timbers, others from material sealed in pits or post holes	4980±35		3930–3660	*3790–3705*	Sheridan 2007a
SUERC-4039	Short-life material. From timber hall, some from structural timbers, others from material sealed in pits or post holes	4975±35		3910–3650	*3790–3705*	Sheridan 2007a
SUERC-4033	Short-life material. From timber hall, some from structural timbers, others from material sealed in pits or post holes	4950±35		3800–3650	*3785–3695*	Sheridan 2007a
SUERC-4034	Short-life material. From timber hall, some from structural timbers, others from material sealed in pits or post holes	4945±35		3800–3640	*3785–3695*	Sheridan 2007a
SUERC-4041	Short-life material. From timber hall, some from structural timbers, others from material sealed in pits or post holes	4945±40		3800–3640	*3790–3695*	Sheridan 2007a
SUERC-4048	Oak charcoal. From timber hall, some from structural timbers, others from material sealed in pits or post holes	5235±35		4230–3960	*4230–4200* (*7%*) or *4170–4125* (*12%*) or *4120–4095* (*3%*) or *4080–3965* (*73%*)	Sheridan 2007a

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SUERC-4044	Oak charcoal. From timber hall, some from structural timbers, others from material sealed in pits or post holes	5205±35		4060–3950	*4225–4205* (*1%*) or *4155–4130* (*3%*) or *4060–3950* (*91%*)	Sheridan 2007a
SUERC-4049	Oak charcoal. From timber hall, some from structural timbers, others from material sealed in pits or post holes	5065±35		3970–3770	*3960–3785*	Sheridan 2007a
Dalladies, Kincardine and Deeside						
I-6113	Wood (seemingly not oak) charcoal from a timber c 15cm in diameter from the SW end of the Phase 2 mortuary enclosure under a stone-revetted earthen long barrow. This measurement conflicts with SRR-289 from the same piece of wood	5190±105				Piggott 1972, 26
SRR-289	Charcoal from the NW end of the Phase 2 mortuary enclosure in an earthen long barrow	4660±50				Piggott 1972, 26
SRR-290	Charcoal from the NW end of the Phase 2 mortuary enclosure (context 30: VII: 71/1) in an earthen long barrow. It should be same date as SRR-289 from a comparable timber nearby	4540±60	−24.9			Piggott 1972, 26
Deer's Den, Kintore Bypass, Aberdeenshire						
OxA-8132	Single charred hazel nutshell from one of a concentration of pits, containing burnt bone, lithics and NE Carinated Bowl pottery	4945±40	−25.2	3800–3640	*3790–3650*	D. Alexander 2000; Sheridan 2007a
OxA-8133	Single charred hazel nutshell from one of a concentration of pits, containing burnt bone, lithics and NE Carinated Bowl pottery	4895±40	−24.7	3770–3630	*3765–3635*	D. Alexander 2000; Sheridan 2007a
Deskford, Leitchestown Farm, Moray						
AA-42986	Alder charcoal (deemed possibly residual by Sheridan 2007, 456) from basal pit fill 1043 with Carinated Bowl pottery in occupation site	5275±50		4250–3970	*4240–3975*	Sheridan 2007a
Douglasmuir, Friockheim, Angus						
GU-1210	Oak charcoal from a post pipe (DM79/T11/ F514/LO1), in a truncated post-hole forming part of end of post-hole enclosure	4855±55	−24.8	3750–3520	*3775–3565*	Kendrick 1995, 33
GU-1469	Oak charcoal from post-hole (DM80 BDD) of a post-hole enclosure. Approximate depth of post-hole 50–70 cm	4895±70	−24.6	3900–3520	*3935–3870* (*5%*) or *3810–3615* (*88%*) or *3605–3570* (*2%*)	Kendrick 1995, 33
GU-1470	Oak charcoal from post-hole (DM80 BAV) of a post-hole enclosure. Taken from a depth of 75 cm of a post pipe	4900±65	−25.2	3900–3530	*3935–3870* (*4%*) or *3810–3620* (*91%*)	Kendrick 1995, 33
Dubton Farm, Brechin, Angus						
AA-39951	Short-life material from upper fill of large pit associated with food processing; modified Carinated Bowl pottery from this fill	4990±45		3950–3650	*3895–3875* (*1%*) or *3825–3650* (*94%*)	Sheridan 2007a; Cameron 2002

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Forest Road, Kintore, Aberdeenshire						
AA-52420	Salix sp. charcoal from feature ST 06, context 11008, burning episode in Phase III. ST06 is a rectilinear ditched long mortuary enclosure (or non-megalithic long barrow)	5040±50	−26.7	3970–3700	*3910–3720*	Sheridan 2007a; Cook and Dunbar 2008
SUERC-1367	Hazel charcoal from feature ST06, context 11006, Phase IIb. No pottery	5250±60	−26.4	4250–3950	*4240–3960*	Sheridan 2007a; Cook and Dunbar 2008
AA-52412	Oak charcoal from feature ST06, context 8264, Phases Ib–IV	5235±45	−26.3	4230–3960	*4230–4195* (*9%*) or *4175–3960* (*86%*)	Cook and Dunbar 2008
AA-52419	Oak charcoal from feature ST06, context 11008, Phase III burning episode. No pottery	5230±50	−25.1	4240–3950	*4230–4195* (*9%*) or *4175–3955* (*86%*)	Sheridan 2007a; Cook and Dunbar 2008
SUERC-1344	Oak charcoal from feature ST06, context 8705, Phases I–IV: ditch fill. Carinated Bowl pottery in same context	5195±45	−25.0	4220–3940	*4230–4200* (*3%*) or *4170–4125* (*5%*) or *4115–4095* (*1%*) or *4075–3940* (*85%*) or *3840–3815* (*1%*)	Cook and Dunbar 2008
SUERC-1371	Hazel charcoal from feature ST06, context 11009, Phase IV: fill of post-hole	5075±45	−26.3	3980–3710	*3865–3700*	Cook and Dunbar 2008
AA-52418	Oak charcoal from feature ST06, context 9961, Phase IV: ditch fill. Carinated Bowl pottery in same context	5080±50	−24.8	3980–3710	*3980–3760*	Sheridan 2007a; Cook and Dunbar 2008
SUERC-3627	Hazelnut shell, deemed residual, from feature O041, context 11274, in occupation with NE Carinated Bowl pottery	4840±40	−25.8	3700–3520	*3710–3615* (*94%*) or *3590–3570* (*1%*)	Sheridan 2007a; Cook and Dunbar 2008
SUERC-4128	Hazelnut shell (deemed residual), from feature O041, context 11274	4690±35	−26.2	3630–3360	*3635–3585*	Cook and Dunbar 2008
SUERC-1375	Alder charcoal from pit P21, context 11132, with NE Carinated Bowl	4835±40	−25.1	3700–3520	*3705–3615* (*92%*) or *3605–3570* (*3%*)	Sheridan 2007a; Cook and Dunbar 2008
SUERC-1324	Hazel charcoal from St 14, context 1501, with NE Carinated Bowl. St 14 is a hollow and stakeholes	4785±50	−26.1	3660–3370	*3695–3680* (*1%*) or *3665–3560* (*94%*)	Sheridan 2007a; Cook and Dunbar 2008
SUERC-1356	Barley grain from pit P14, context 9099. 2 saddle querns and burnt bone but no pottery	4755±45	−24.3	3650–3370	*3650–3570*	Cook and Dunbar 2008
SUERC-2654	Hazelnut shell, from pit P38, context 11338, with NE Carinated Bowl pottery and flint	4755±35	−25.1	3640–3370	*3645–3575*	Cook and Dunbar 2008
SUERC-2646	Wheat grain from pit P31, context 11139, with NE Carinated Bowl pottery	4740±35	−23.8	3640–3370	*3640–3575*	Cook and Dunbar 2008
SUERC-1355	Wheat grain from pit P14, context 9099. 2 saddle querns and burnt bone but no pottery	4735±110	−24.0	3710–3130	*3710–3570*	Cook and Dunbar 2008

Laboratory Number	Description	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*	References
SUERC-1384	Birch charcoal from pit P50, context 11415, with NE Carinated Bowl pottery	4970±40	−26.2	3930–3650	*3755–3640*	Sheridan 2007a; Cook and Dunbar 2008
SUERC-1325	Hazel charcoal from pit P12, context 5504, with NE Carinated Bowl pottery	4865±50	−24.9	3750–3530	*3720–3615*	Sheridan 2007a; Cook and Dunbar 2008
SUERC-1323	Oak charcoal from feature St14, context 1501, with NE Carinated Bowl pottery. St 14 is a hollow and stakeholes	4855±40	−24.1	3710–3530	*3705–3625*	Cook and Dunbar 2008
SUERC-1374	Birch charcoal from feature P25, context 11131, a cremation pit, with NE Carinated Bowl pottery and flint	4895±45	−25.2	3780–3630	*3720–3630*	Sheridan 2007a; Cook and Dunbar 2008
SUERC-1376	Alder charcoal from pit P35, context 11315, with NE Carinated Bowl pottery and stone axe fragment	4965±40	−27.3	3910–3650	*3755–3640*	Sheridan 2007a; Cook and Dunbar 2008
Fordhouse Barrow, Dun, Angus						
OxA-8222	The 35 outer rings of a radially split oak plank used to build a mortuary structure in the phase 3B mound of a non-megalithic long barrow. Carinated Bowl associated with funerary activities linked with this structure	5035±40	−24.4	3960–3700	*3950–3755* (*88%*) or *3745–3710* (*7%*)	Ashmore 1999b; Sheridan 2007a
OxA-8223	The outer rings of a radially split oak plank used to build a mortuary structure in the phase 3B mound of a non-megalithic long barrow. Carinated Bowl associated with funerary activities linked with this structure	4920±45	−24.9	3800–3630	*3785–3635*	Ashmore 1999b; Sheridan 2007a
OxA-8224	Large fragments from an oak timber used to build a mortuary structure in the phase 3B mound of a non-megalithic long barrow. Carinated Bowl associated with funerary activities linked with this structure	4965±40	−26.4	3910–3650	*3915–3875* (*6%*) or *3805–3650* (*89%*)	Ashmore 1999b; Sheridan 2007a
Garthdee Road, Aberdeenshire						
SUERC-8607	Barley grain from occupation layer 49 in site with oval post-defined structure, pit and occupation layer, associated with Carinated Bowl pottery	4935±35	−25.9	3790–3640	*3780–3650*	Sheridan 2007a; Ashmore 2005
SUERC-8608	Barley grain from occupation layer 49 in site with oval post-defined structure, pit and occupation layer, associated with Carinated Bowl pottery	4925±35	−26.7	3790–3640	*3775–3645*	Sheridan 2007a; Ashmore 2005
SUERC-8609	Hazelnut shell from hearth 55 in oval post-defined structure, in site with pit and occupation layer, associated with Carinated Bowl pottery	4930±35	−26.5	3790–3640	*3775–3645*	Sheridan 2007a; Ashmore 2005
SUERC-8613	Barley grain from hearth 55 in oval post-defined structure, in site with pit and occupation layer, associated with Carinated Bowl pottery	4950±35	−27.0	3800–3650	*3790–3655*	Sheridan 2007a; Ashmore 2005
SUERC-8616	Barley grain from hearth 57 in oval post-defined structure, in site with pit and occupation layer, associated with Carinated Bowl pottery	4970±35	−27.5	3910–3650	*3800–3655*	Sheridan 2007a; Ashmore 2005
SUERC-8617	Hazelnut shell from hearth 57 in oval post-defined structure, in site with pit and occupation layer, associated with Carinated Bowl pottery	5020±35	−25.1	3950–3700	*3905–3855* (*5%*) or *3850–3700* (*90%*)	Sheridan 2007a; Ashmore 2005

Laboratory Number	Description	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	Calibrated date range (cal BC) (95% confidence)	*Posterior density estimate (cal BC) (95% probability)*	References
Inchtuthil, Perth and Kinross						
GU-2760	Burnt oak fencing timbers of a long mortuary enclosure	5160±70	−25.9	4230–3790	*4230–4200* (*3%*) or *4170–4125* (*4%*) or *4120–4095* (*1%*) or *4080–3780* (*87%*)	Barclay and Maxwell 1998, 35
GU-2761	Burnt oak fencing timbers of a long mortuary enclosure	5070±50	−25.8	3980–3710	*3970–3760* (*94%*) or *3725–3710* (*1%*)	Barclay and Maxwell 1998, 35
Lesmurdie Road, Elgin, Moray						
Poz-5483	Oak charcoal from lower fill F31/3 of pit 51, in occupation site, which has Carinated Bowl pottery in its upper fill	5025±35		3950–3700	*3945–3710*	Ashmore 2004b; Sheridan 2007a
Poz-5482	Hazel charcoal from lower fill F31/3 of pit 51, in occupation site, which has Carinated Bowl pottery in its upper fill	2500±30		790–510		Ashmore 2004b; Sheridan 2007a
Midtown of Pitglassie, Aberdeenshire						
GrA-34772	Cremated human bone fragment from shallow depression close to location of probable pyre, sealed beneath NM round cairn; associated with NE Carinated Bowl	4995±35		3940–3690	*3895–3875* (*1%*) or *3815–3690* (*92%*) or *3685–3660* (*2%*)	Sheridan 2007b
GU-2014	Bulk wood charcoal (ash, alder, birch, beech, willow) forming a deposit on a NE Carinated Bowl in the main pit in the area surrounded by the ring-mound.	4935±105	−26.0	3970–3510	*3965–3615*	A. Shepherd 1996, 22; G. Barclay *et al.* 2002
GU-2049	Bulk wood charcoal (ash, alder, birch, beech, willow) from a deposit at the base of the ring-mound with NE Carinated Bowl pottery	4660±50	−25.3	3630–3350	*3640–3575*	A. Shepherd 1996, 22; G. Barclay *et al.* 2002

[1] Calibrated using the marine data of Hughen *et al.* 2004 and a ΔR value of 5±40 (Harkness 1993)
[2] Calibration of weighted mean of 5084±67 BP (T' =1.1; T'(5%) = 3.8, ν=1)

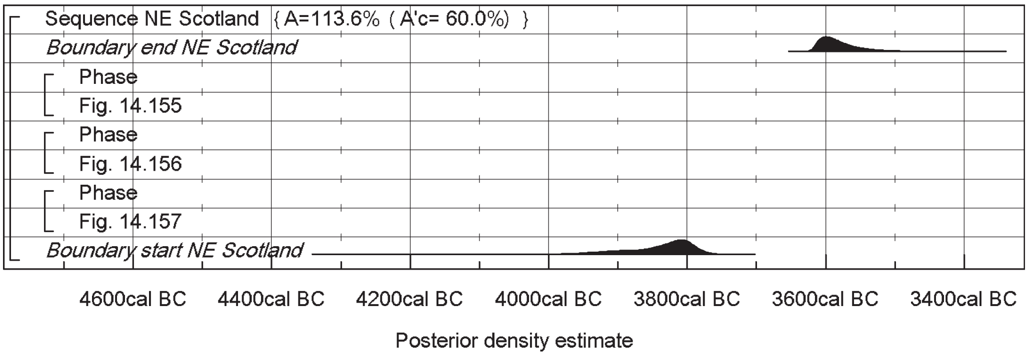


Fig. 14.154. Overall structure of the chronological model for early Neolithic activity in north-east Scotland. The format is identical to that for Fig. 14.1. The components of this model are given in detail in Figs 14.155–7. The large square brackets down the left-hand side of Figs 14.154–7, along with the OxCal keywords, define the overall model exactly.

and dates from such other recent publications as were available to us at the time of writing in 2009 (Lelong and MacGregor 2007; Cook and Dunbar 2008). This 'grab' sample incorporates the results from a wide range of research and contract archaeology projects, encompassing many of the shifts in emphasis in the archaeology of the Neolithic in Scotland that have taken place over recent years, summarised by Brophy (2006). Thus alongside a handful of determinations from western chambered cairns, generally few per site, often poorly contexted and regularly not on short-life material, there are increasing numbers of dates from eastern, lowland house sites, occupation sites, non-megalithic long barrows/mortuary enclosures, and linear monuments. Since this is an indicative exercise only, with no claims to completeness, we have chosen to exclude dates from north of the Great Glen, consciously here leaving aside the important but patchy radiocarbon dating evidence from the Western Isles, Caithness, and the Orkney and Shetland Islands; this decision also excludes the dates from the Oronsay middens.

We begin by presenting two models for the chronology of the first Neolithic things and practices in Scotland south of the Great Glen, covering respectively south and north-east Scotland. Both of these models include dates associated with all types of northern Carinated Bowl pottery, dates from early Neolithic monument types (long barrows and rectilinear mortuary enclosures, chambered cairns, non-megalithic round mounds, and linear constructions), dates from rectangular timber halls, and dates associated with other diagnostically Neolithic material, such as cereal grains and ground stone axeheads. Details of the dates included in the models presented here are given in Table 14.14 and the location of the sites mentioned is shown in Fig. 14.149.

Figure 14.150 shows the overall structure of the chronological model for early Neolithic activity in southern Scotland, here defined as land between the present English border and a line drawn roughly between the Tay at Perth, along Strathearn and past Tyndrum to Loch Etive (on whose north side lies the Achnacreebeag monument: Chapter 1.5). Figures 14.151−3 show the components of this model. The dates have been incorporated in the models on the same principles as those used throughout the rest of this volume. So, for example, the three dates from Balfarg Riding School (*GU-1903, -2604−5*: Fig. 14.151), all on bulk samples of charcoal which contained a component of wood which could have had a potentially significant age-offset (Table 14.14), have been treated as *termini post quos* for the end of early Neolithic activity in southern Scotland. In contrast, *GU-4279* from Biggar Common East (Fig. 14.151) has been included in the model as a sample on short-life material directly associated with the use of early Neolithic pottery, in this case probably traditional Carinated Bowl. The radiocarbon dates on the timber hall from Claish (G. Barclay *et al*. 2002) have been included in a component model for the chronology of that structure (for example, in the way that we have treated the dates from the Hazleton long cairn, elsewhere in this chapter). This ensures that a large number of radiocarbon dates from a single site do not unbalance the model. In effect, the twelve radiocarbon dates have been distilled into two parameters for the chronology of this site, which are effective in the overall chronological model for the early Neolithic in southern Scotland. Where appropriate, marine samples, such as the cockle shell at Crarae (*OxA-7880*; Fig. 14.151) have been calibrated using the marine dataset of Hughen *et al*. (2004) and a ΔR value of 5±40 BP (Stuiver and Braziunas 1993). Stratigraphic sequences have been included in the models for the long barrows/enclosures at Eweford West and Pencraig Hill (Figs 14.152−3; Lelong and MacGregor 2007), for the chambered cairn at Port Charlotte (Fig. 14.153; Sheridan 2007a), and a pit at Maybury (Fig. 14.152; Sheridan 2007a).

This model suggests that the early Neolithic began in southern Scotland in *3835–3760 cal BC* (*95% probability*; Fig. 14.150: *start S Scotland*), probably in *3815–3780 cal BC* (*68% probability*). This phase of activity ended in *3620–3535 cal BC* (*95% probability*; Fig. 14.150: *end S Scotland*), probably in *3610–3570 cal BC* (*68% probability*).

A similar model for the chronology of the early Neolithic in north-east Scotland is shown in Figs 14.154−7. Site-specific models for the timber halls at Balbridie and Crathes (Fairweather and Ralston 1993; Sheridan 2007a; H. Murray *et al*. 2009)[9] are similarly incorporated in this overall model (Fig. 14.155), so that the number of measurements from

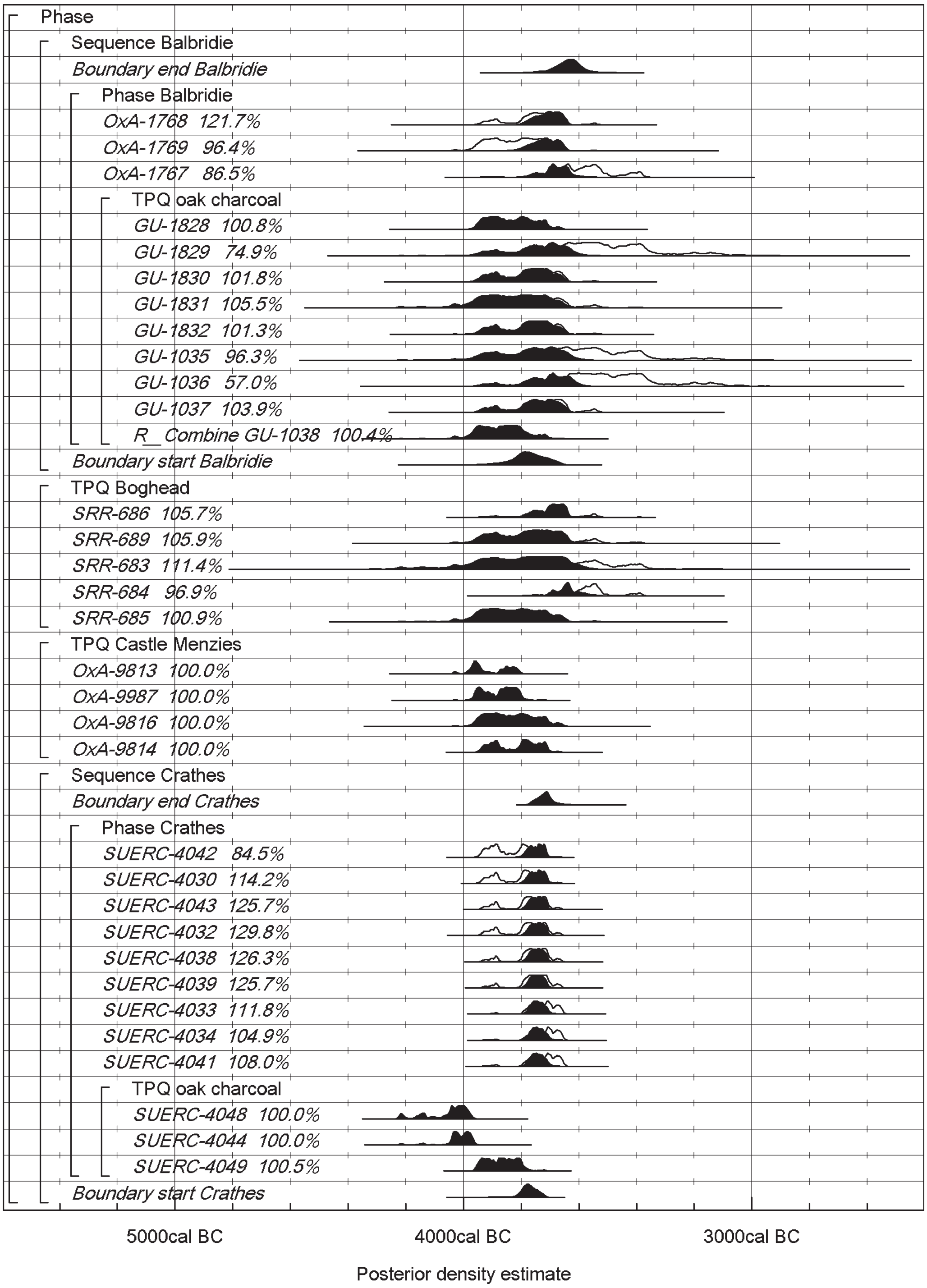


Fig. 14.155. Probability distributions of dates for early Neolithic activity in north-east Scotland. The format is identical to that for Fig. 14.1. The overall structure of this model is shown in Fig. 14.154, and its other components in Figs 14.156–7.

them does not unbalance the sample. A similar approach has also been taken for the pit site at Forest Road, Kintore, whose dating is exemplary (Cook and Dunbar 2008). Here *SUERC-1356*, for example, has been included in the model, as it is on a cereal grain from a pit with saddle querns, even though the pit did not contain any pottery. The stratigraphic sequence for the long barrow/enclosure at Forest Road, Kintore (Cook and Dunbar 2008), has also been included in the model (Fig. 14.156). Two dates on short-life samples have been included as *termini post quos* only: *AA-42986* from Deskford, which is deemed possibly residual (Sheridan 2007a, 456) and *SUERC-3627* from Forest Road, Kintore, which is deemed residual by the excavators (Cook and Dunbar 2008, 30). GU-3911 and -3912, two fifth millennium cal BC dates from a feature beneath the Cleaven Dyke, Perth and Kinross (Table 14.14), are not modelled because the interval between them and the building of the monument is too great to make them informative as *termini post quos*.

This model suggests that the early Neolithic began in

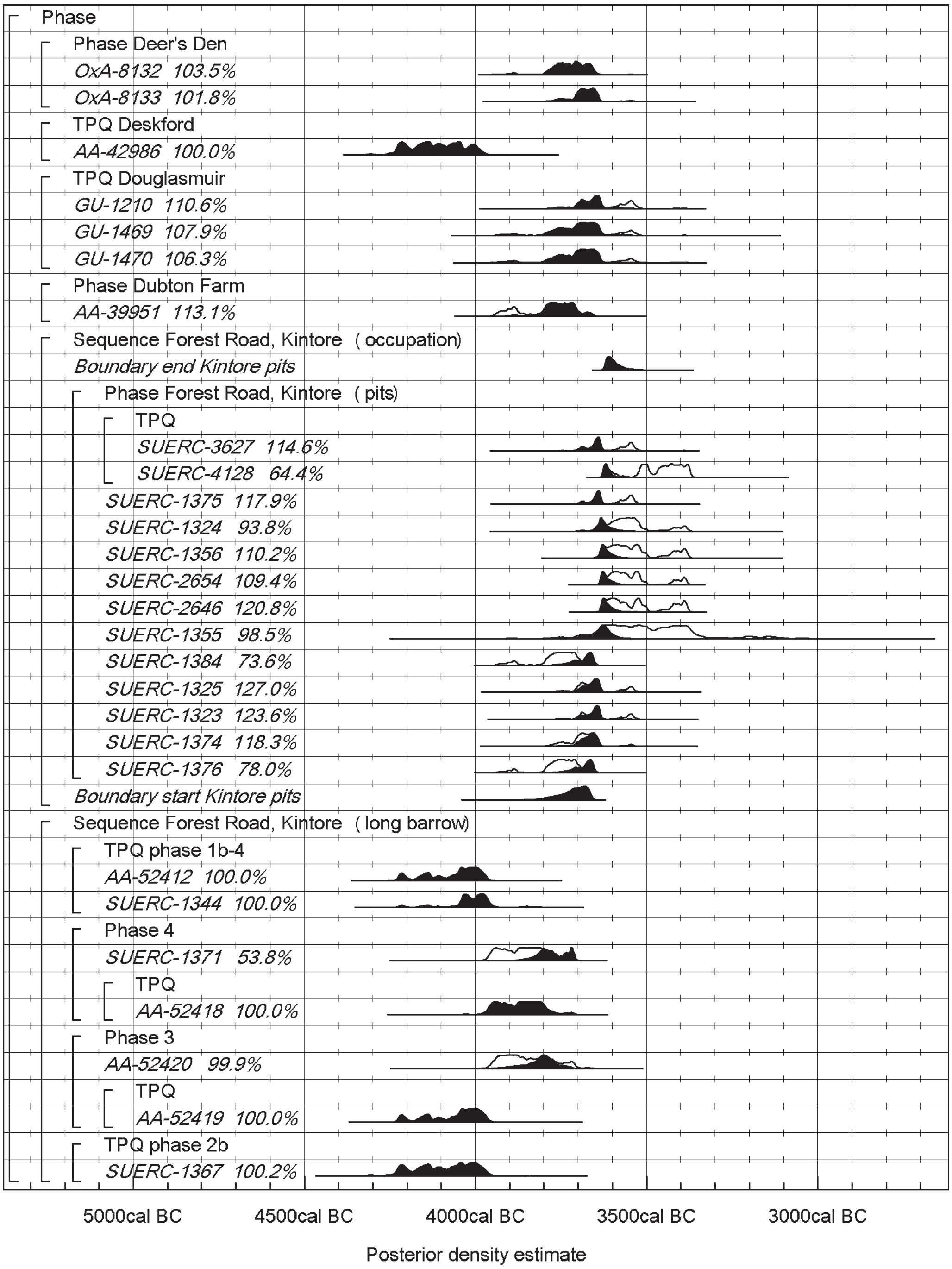


Fig. 14.156. Probability distributions of dates for early Neolithic activity in north-east Scotland. The format is identical to that for Fig. 14.1. The overall structure of this model is shown in Fig. 14.154, and its other components in Figs 14.155 and 14.157.

north-east Scotland in *3950–3765 cal BC* (*95% probability*; Fig. 14.154: *start NE Scotland*), probably in *3865–3780 cal BC* (*68% probability*). This phase of activity ended in *3625–3520 cal BC* (*95% probability*; Fig. 14.154: *end NE Scotland*), probably in *3615–3570 cal BC* (*68% probability*).

These models provide two independent estimates for the date when the first Neolithic things and practices appeared in different parts of Scotland. It is now time to investigate whether the different elements of the Neolithic appeared synchronously. Figure 14.158 shows the overall structure of a model for the chronology of all the variants of Carinated Bowl in Scotland south of the Great Glen. This includes all dates associated with traditional Carinated Bowl, North-East Carinated Bowl, and modified Carinated Bowl as defined by Sheridan (2007a). The components of this model are shown in Figs 14.160–4, without the surrounding uniform phase boundaries in Figs 14.163 and 14. 164 (although the posterior density estimates shown on these figures are not those relating to this model).

This model suggests that Carinated Bowl pottery first appeared in Scotland south of the Great Glen in *3825–3750*

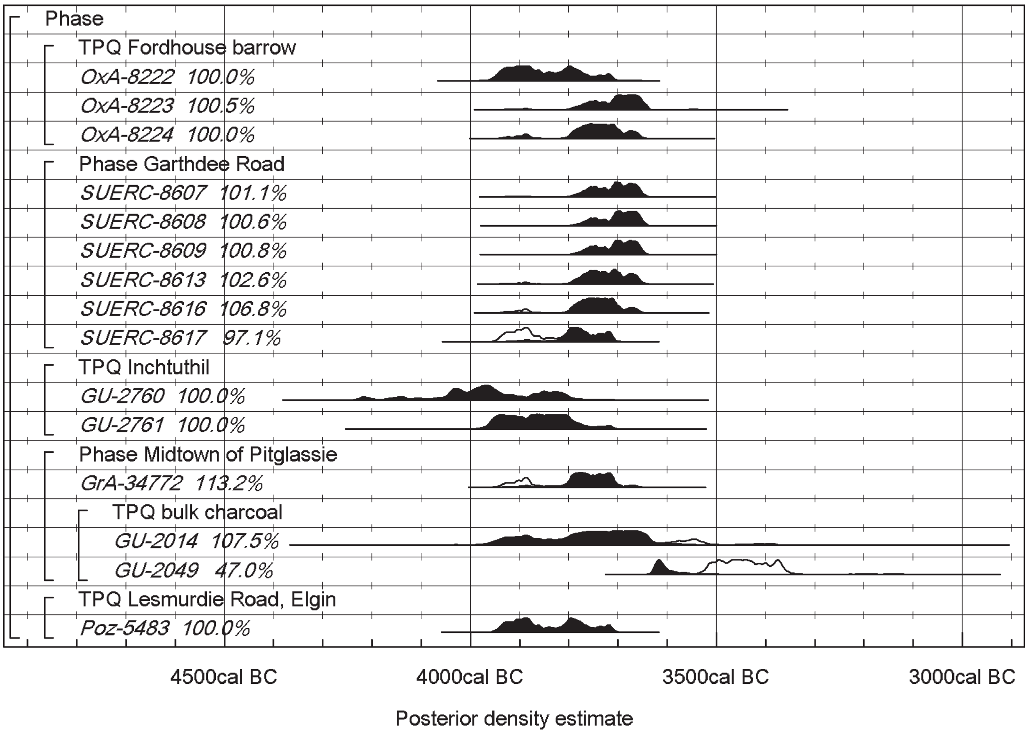


Fig. 14.157. Probability distributions of dates for early Neolithic activity in north-east Scotland. The format is identical to that for Fig. 14.1. The overall structure of this model is shown in Fig. 14.154, and its other components in Figs 14.155–6.

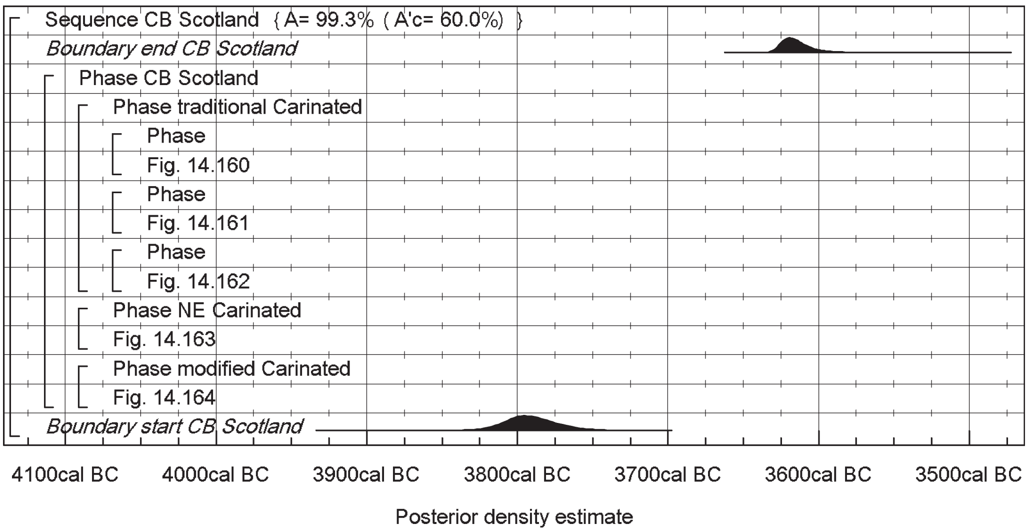


Fig. 14.158. Overall structure of the chronological model for all types of Carinated Bowl in Scotland south of the Great Glen. The format is identical to that for Fig. 14.1. The components of the model are given in detail in Figs 14.160–2 and between the uniform phase boundaries of the models shown in Figs 14.163 and 14.164 (although the posterior density estimates shown on these figures are not those relating to this model). The large square brackets down the left-hand side of these figures, along with the OxCal keywords, define the overall model exactly.

cal BC (*95% probability*; Fig. 14.158: *start CB Scotland*), probably in *3810–3775 cal BC* (*68% probability*). The currency of Carinated Bowl in this area ended in *3635–3590 cal BC* (*95% probability*; Fig. 14.158: *end CB Scotland*), probably in *3630–3605 cal BC* (*68% probability*).

Figure 14.159 shows the overall structure for the chronological model for the currency of traditional Carinated Bowl in Scotland south of the Great Glen, with the components given in Figs 14.160–2. This model suggests that traditional Carinated Bowl pottery first appeared in Scotland south of the Great Glen in *3825–3740 cal BC* (*95% probability*; Fig. 14.159: *start traditional Carinated*), probably in *3810–3765 cal BC* (*68% probability*). The currency of traditional Carinated Bowl in this area ended

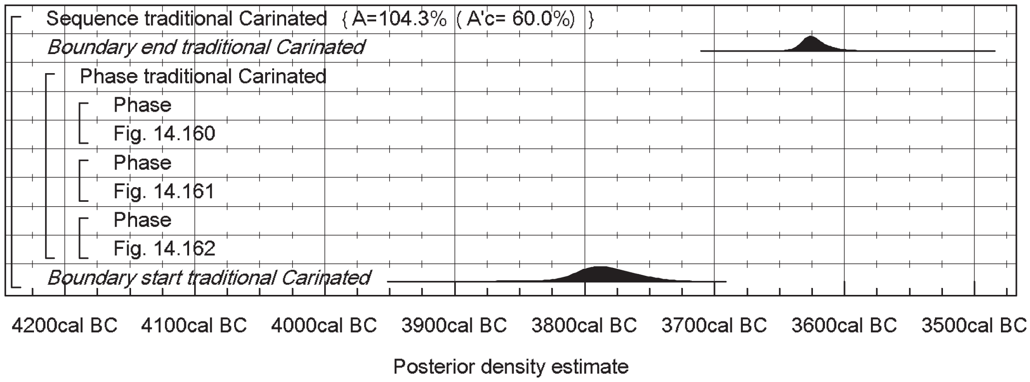


Fig. 14.159. Overall structure of the chronological model for traditional Carinated Bowl in Scotland south of the Great Glen. The format is identical to that for Fig. 14.1. The components of the model are given in detail in Figs 14.160–2. The large square brackets down the left-hand side of Figs 14.159–62, along with the OxCal keywords, define the overall model exactly.

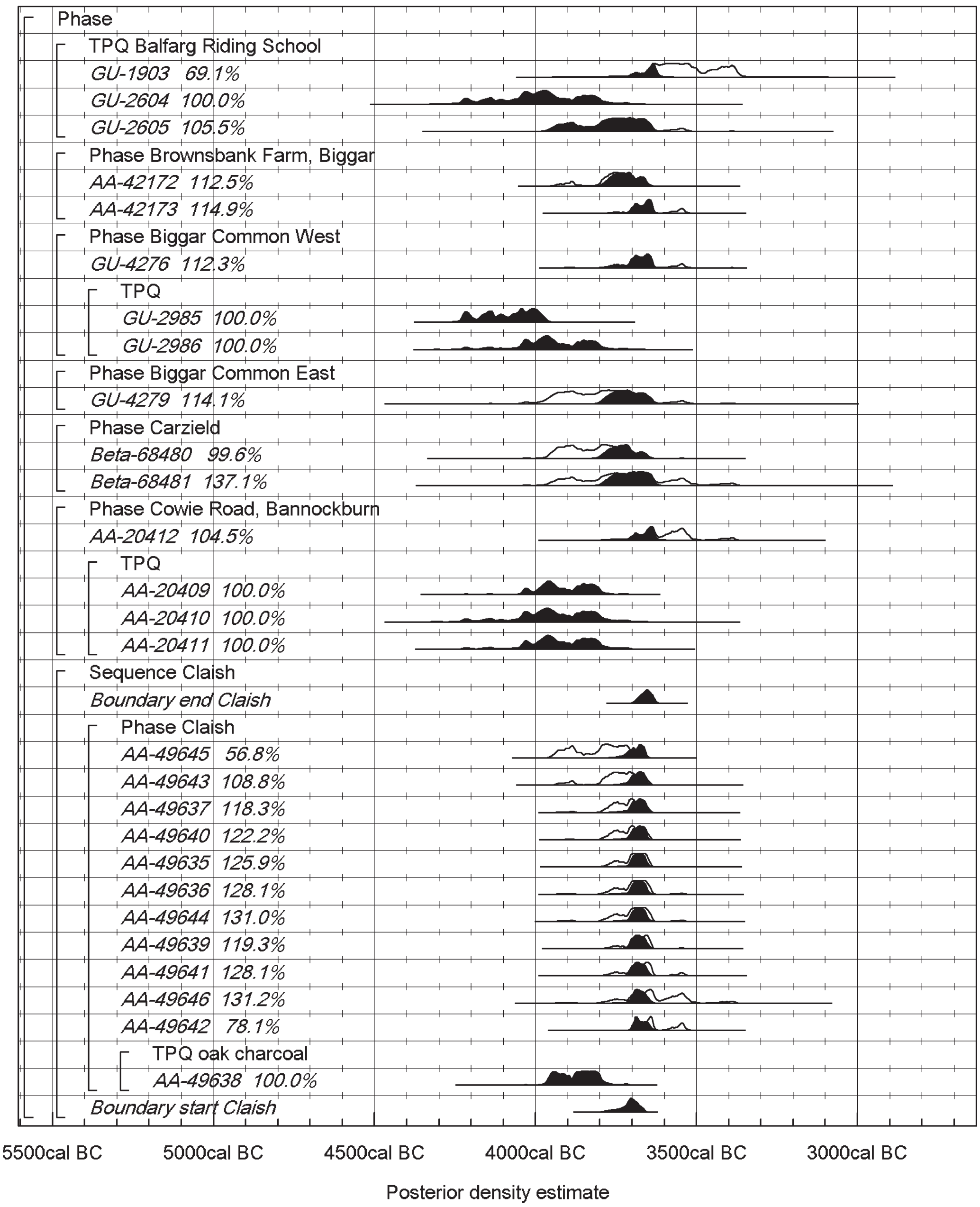


Fig. 14.160. Probability distributions of dates for samples associated with traditional Carinated Bowl in Scotland south of the Great Glen. The format is identical to that for Fig. 14.1. The overall structure of this model is shown in Fig. 14.159, and its other components in Figs 14.161–2.

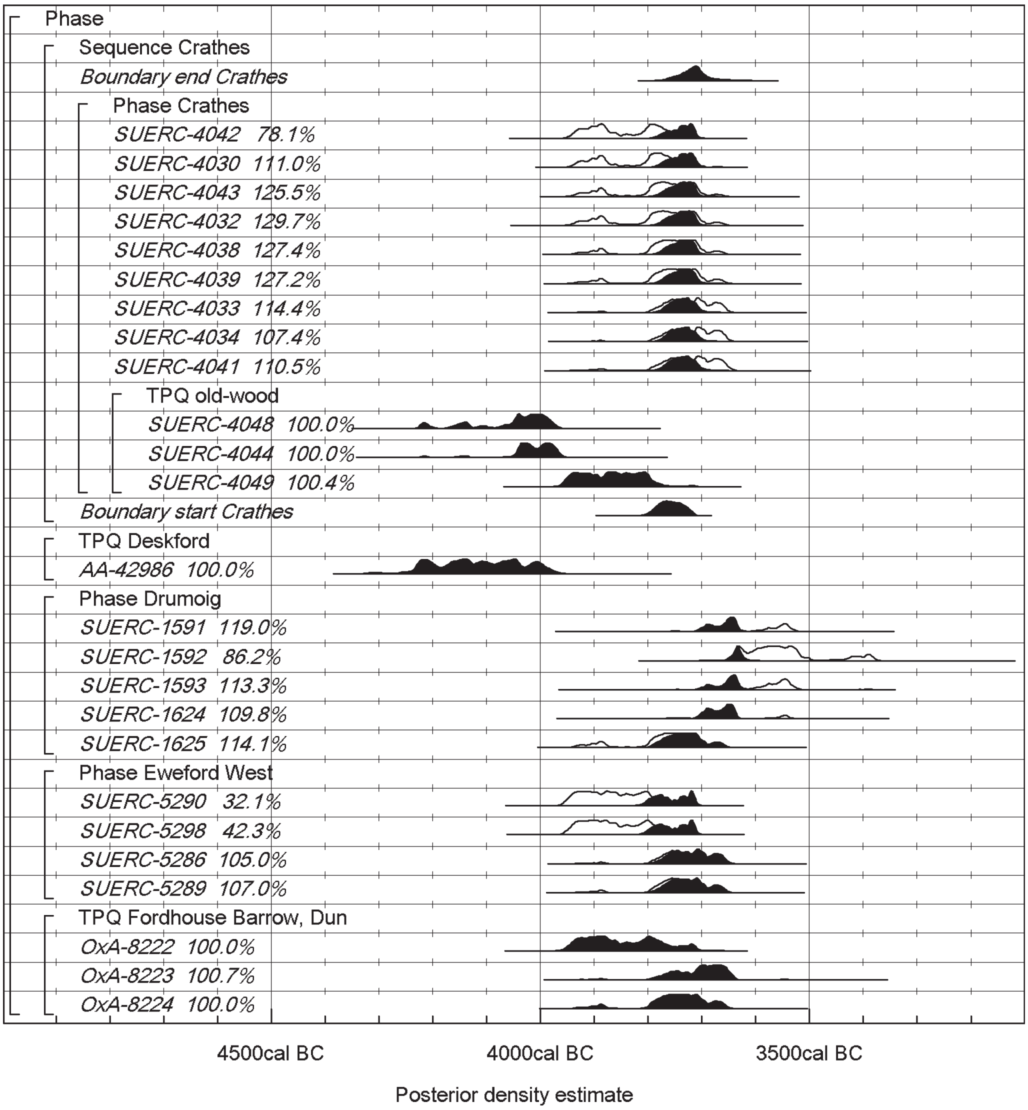


Fig. 14.161. Probability distributions of dates for samples associated with traditional Carinated Bowl in Scotland south of the Great Glen. The format is identical to that for Fig. 14.1. The overall structure of this model is shown in Fig. 14.159, and its other components in Figs 14.160 and 14.162.

in *3645–3595 cal BC* (*95% probability*; Fig. 14.159: *end traditional Carinated*), probably in *3635–3615 cal BC* (*68% probability*).

Figure 14.163 shows a model for the chronology of North-East Carinated Bowl pottery, in this case in a relatively restricted part of north-east Scotland between the rivers Dee and Spey. This model suggests that North-East Carinated Bowl pottery first appeared in Scotland south of the Great Glen in *4030–3725 cal BC* (*95% probability*; Fig. 14.163: *start NE Carinated*), probably in *3905–3770 cal BC* (*68% probability*). The currency of this variant of Carinated Bowl in this area ended in *3635–3420 cal BC* (*95% probability*; Fig. 14.163: *end NE Carinated*), probably in *3625–3540 cal BC* (*68% probability*). These estimates are imprecise – wider than those for traditional Carinated Bowl – because they depend on relatively few data, particularly once the large assemblage of dates from Balbridie is appropriately weighted in the model.

Figure 14.164 shows a chronological model for modified Carinated Bowl in Scotland south of the Great Glen, although it should be noted that data for this type of ceramic are severely restricted. This model suggests that modified Carinated Bowl pottery first appeared in Scotland south of the Great Glen in *4250–3650 cal BC* (*95% probability*; Fig. 14.164: *start modified Carinated*), probably in *3925–3690 cal BC* (*68% probability*). The currency of this variant of Carinated Bowl in this area ended in *3645–3110 cal BC* (*95% probability*; Fig. 14.164: *end modified Carinated*), probably in *3590–3390 cal BC* (*68% probability*).

The date estimates for the currency of all three variants of northern Carinated Bowl are shown in Fig. 14.165. All are consistent with the first appearance of the variants in the decades around 3800 cal BC.[10] On the available evidence, it is *86% probable* that North-East Carinated Bowl came into use slightly earlier than traditional Carinated Bowl, although this may be only the difference between the generation before 3800 cal BC and their children. This subtle trend needs to be confirmed by further dating of

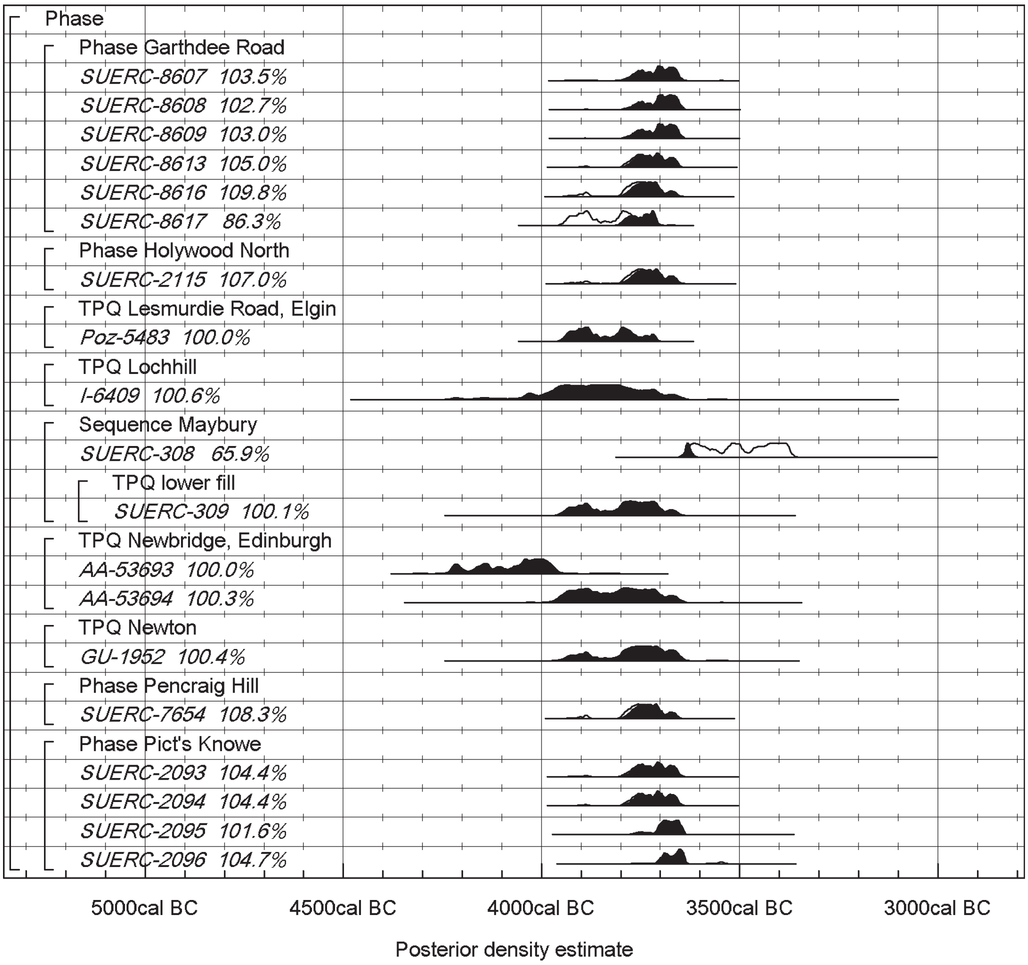


Fig. 14.162. Probability distributions of dates for samples associated with traditional Carinated Bowl in Scotland south of the Great Glen. The format is identical to that for Fig. 14.1. The overall structure of this model is shown in Fig. 14.159, and its other components in Figs 14.160–1.

North-East Carinated Bowl assemblages, as at present we may simply have too few dated sites effectively to deal with the scatter on the assemblage of calibrated dates for this pottery type. It is still perfectly possible that the introduction of all three variants of northern Carinated Bowl to Scotland was precisely contemporary. Modified Carinated Bowl is particularly poorly dated and must be a priority for further research. There are hints, however, in the existing dating, that this variant may begin a few generations later than the other two variants, and perhaps carry on in use into the 36th century cal BC (Fig. 14.165).

It is now time to consider the date of early Neolithic monuments in Scotland south of the Great Glen. The overall structure for a chronological model for their currency is given in Fig. 14.166, with the component parts relating to Scottish long barrows given in Fig. 14.168 and between the surrounding uniform phase boundaries of Fig. 14.167, the component for chambered cairns being given between the uniform phase boundaries of Fig. 14.169, and the component parts for linear monuments and non-megalithic round mounds in Figs. 14.170–1 (although the posterior density estimates shown on these figures are not those relating to this model). This model suggests that the first early Neolithic monument was constructed in Scotland in *3955–3785 cal BC* (*95% probability*; Fig. 14.166: *start Scottish monuments*), probably in *3920–3885 cal BC* (*14% probability*) or *3870–3795 cal BC* (*54% probability*). This phase of activity ended in *3620–3540 cal BC* (*95% probability*; Fig. 14.166: *end Scottish monuments*), probably in *3610–3570 cal BC* (*68% probability*).

A separate chronological model for the currency of Scottish long barrows and related forms is shown in Figs 14.167–8. This model does not include the three radiocarbon dates from Dalladies (Table 14.14; I-6113, SRR-289–90), since I-6113 and SRR-289 were from the same piece of wood and produced statistically significantly different radiocarbon measurements (T'=21.6; T'(5%)=3.8, ν=1) and SRR-290 from the same context has extremely low individual agreement when included in this model (A=2.3%), and may be anomalously young. In these circumstances, it appears prudent to exclude all these dates from the analysis. We have also included *I-6409* from Lochhill in this model, as it relates to the timber mortuary structure preceding a rebuild in stone (Masters 1973).

This model suggests that the first long barrow or variant form in Scotland south of the Great Glen was

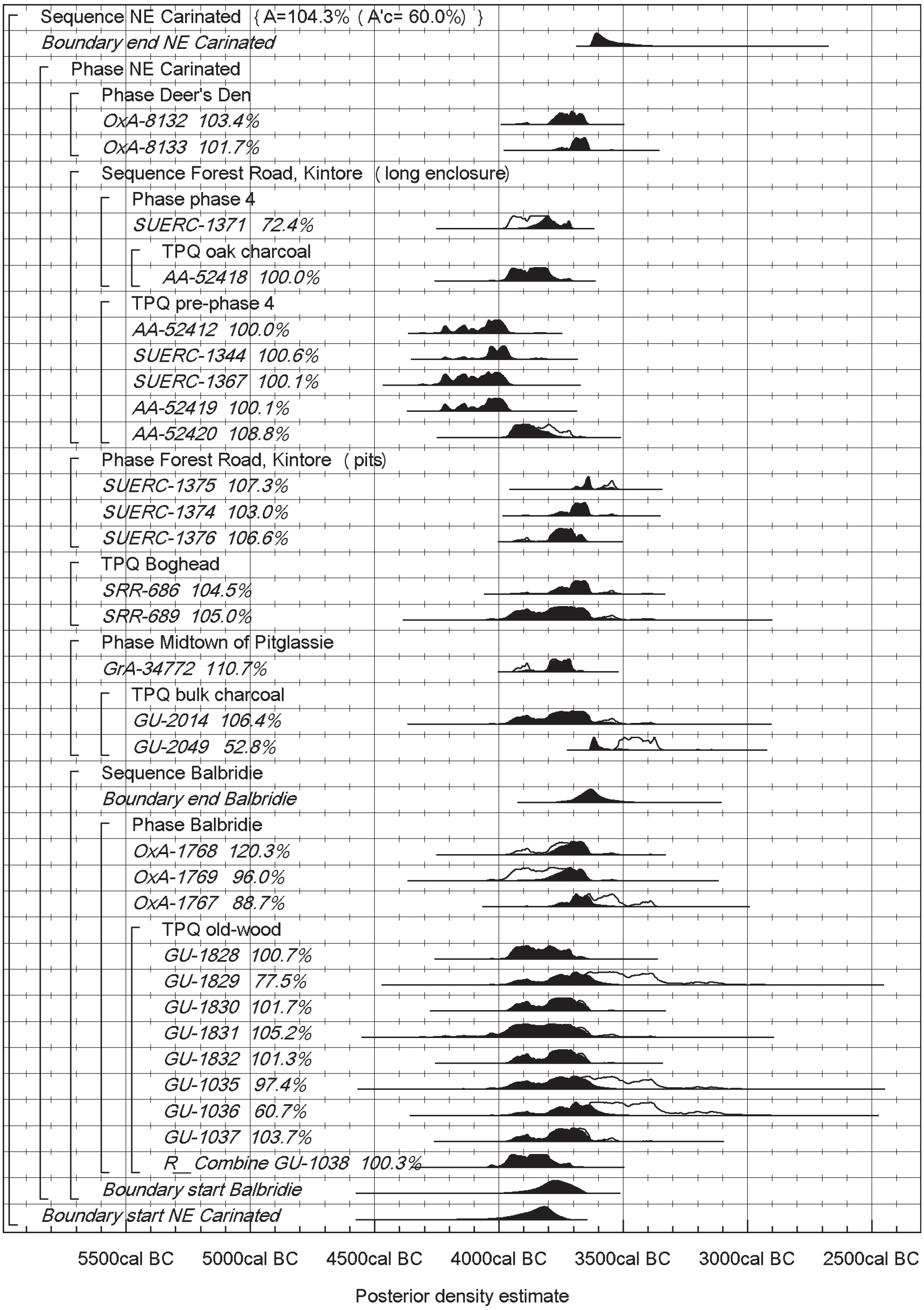


Fig. 14.163. Probability distributions of dates associated with North-East Carinated Bowl in Scotland south of the Great Glen. The format is the same as for Fig. 14.1. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

constructed in *3935–3750 cal BC* (*94% probability*; Fig. 14.167: *start Scottish long barrows*) or *3745–3735 cal BC* (*1% probability*), probably in *3840–3775 cal BC* (*68% probability*). This phase of activity ended in *3760–3620 cal BC* (*95% probability*; Fig. 14.167: *end Scottish long barrows*), probably in *3705–3640 cal BC* (*68% probability*).

A model for the currency of chambered cairns in this part of Scotland is shown in Fig. 14.169. Again, dates are scarce, and only three provide more than *termini post quos* for their contexts. On this scanty evidence, we estimate that this type of construction began in *4295–3495 cal BC* (*95% probability*; Fig. 14.169: *start Scottish chambered cairns*), probably in *3800–3560 cal BC* (*68% probability*). This phase of activity ended in *3625–3180 cal BC* (*95% probability*; Fig. 14.169: *end Scottish chambered cairns*),

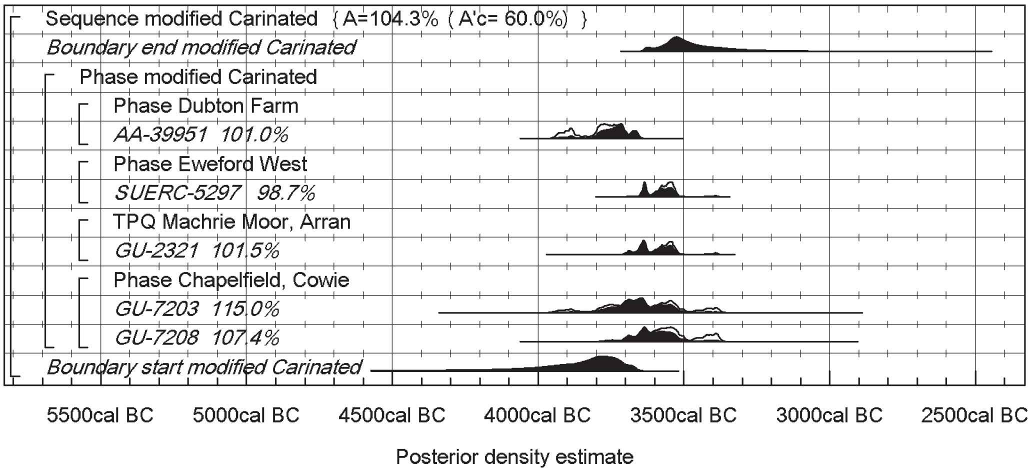


Fig. 14.164. Probability distributions of dates associated with modified Carinated Bowl in Scotland south of the Great Glen. The format is the same as for Fig. 14.1. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

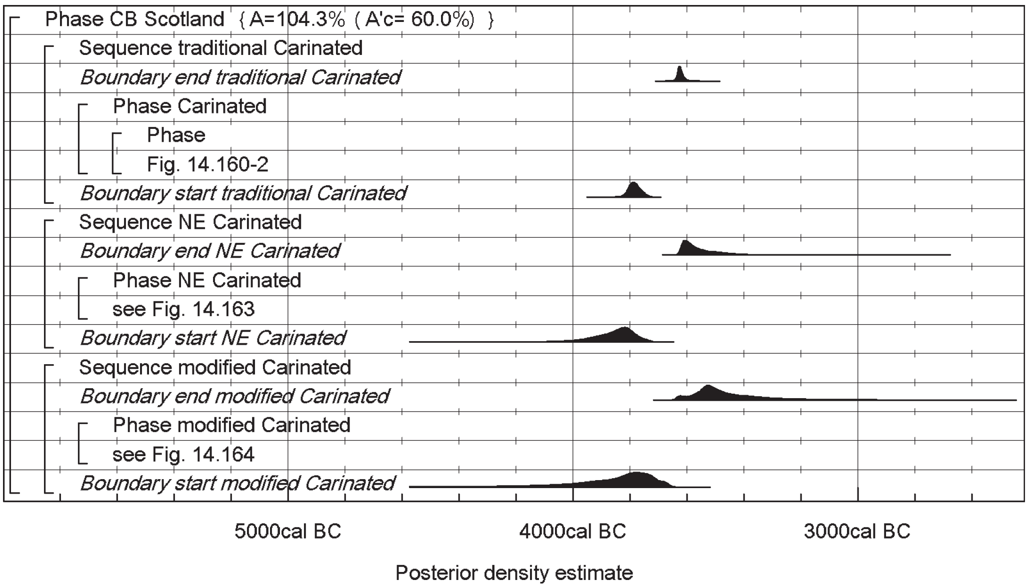


Fig. 14.165. Probability distributions for the currency of different types of Carinated Bowl in Scotland south of the Great Glen, derived from the models shown in Figs 14.159–62, 14.163, and 14.164.

probably in *3600–3555 cal BC* (*10% probability*) or *3525–3335 cal BC* (*58% probability*).

The dating of linear monuments in Scotland south of the Great Glen is known even less securely. Of the 29 calibrated radiocarbon dates shown on Fig. 14.170, only one is on short-life material. This calibrates to 3710–3380 cal BC (95% confidence; Table 14.14: AA-20412). This date and the even later *termini post quos* for the Holywood North monument provided by SUERC-2114 and SUERC-2116, provide the only firm dating for these monuments. This places them in the middle centuries of the fourth millennium cal BC. A date from the Dunragit cursus (Table 14.14: SUERC-2103) is excluded from our modelling here because the context and taphonomy of the sample remain uncertain pending full publication. If truly associated with the monument, it also supports a date in the middle rather the early centuries of the fourth millennium cal BC for these constructions. On the basis of the radiocarbon dates currently available (Fig. 14.170), there is no evidence that any of these monuments predate *c.* 3700 cal BC (*contra* J. Thomas 2006, 233), and some examples, such as that at Holywood North, may be a century or two later. An origin around 3700 cal BC for this monument tradition is compatible with their association with Carinated Bowl (and the chronologies presented for that pottery type here; Fig. 14.158), and allows the possibility that it was in some way a northern alternative to the practice of building enclosures further south (we are grateful to the anonymous referee for this suggestion). The claim that they represent '"public architecture" as opposed to the more colossal *monumentality* of the long cairns and causewayed enclosures which developed after 3800 BC and 3650 cal BC respectively' (J. Thomas 2006, 233) cannot be supported.

The dating of non-megalithic round mounds (cf. Kinnes

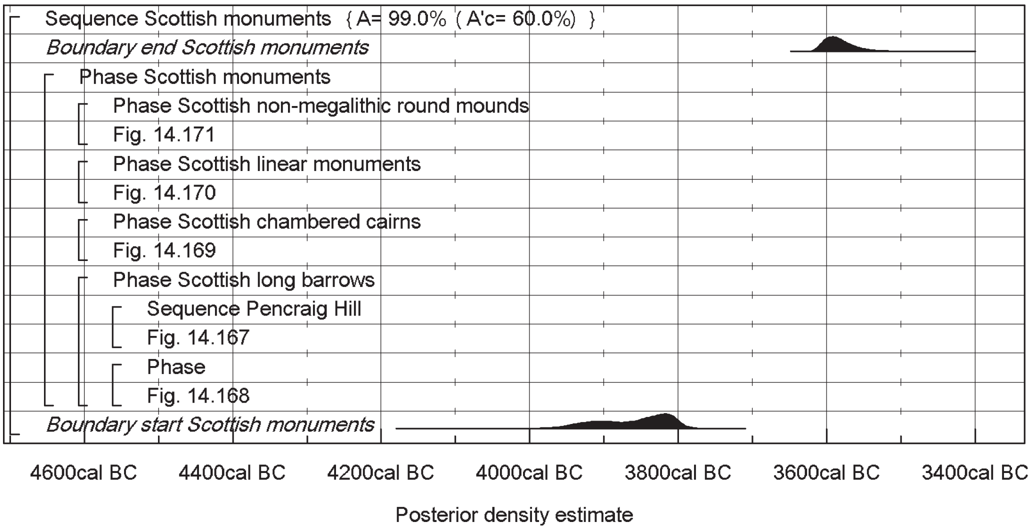


Fig. 14.166. Overall structure of the chronological model for early Neolithic monuments in Scotland south of the Great Glen. The format is identical to that for Fig. 14.1. The components of the model are given in detail in Figs 14.167–71 (without the surrounding boundaries in Figs 14.167 and 14.169) (although the posterior density estimates shown on these figures are not those relating to this model). The large square brackets down the left-hand side of Figs 14.166–71, along with the OxCal keywords, define the overall model exactly.

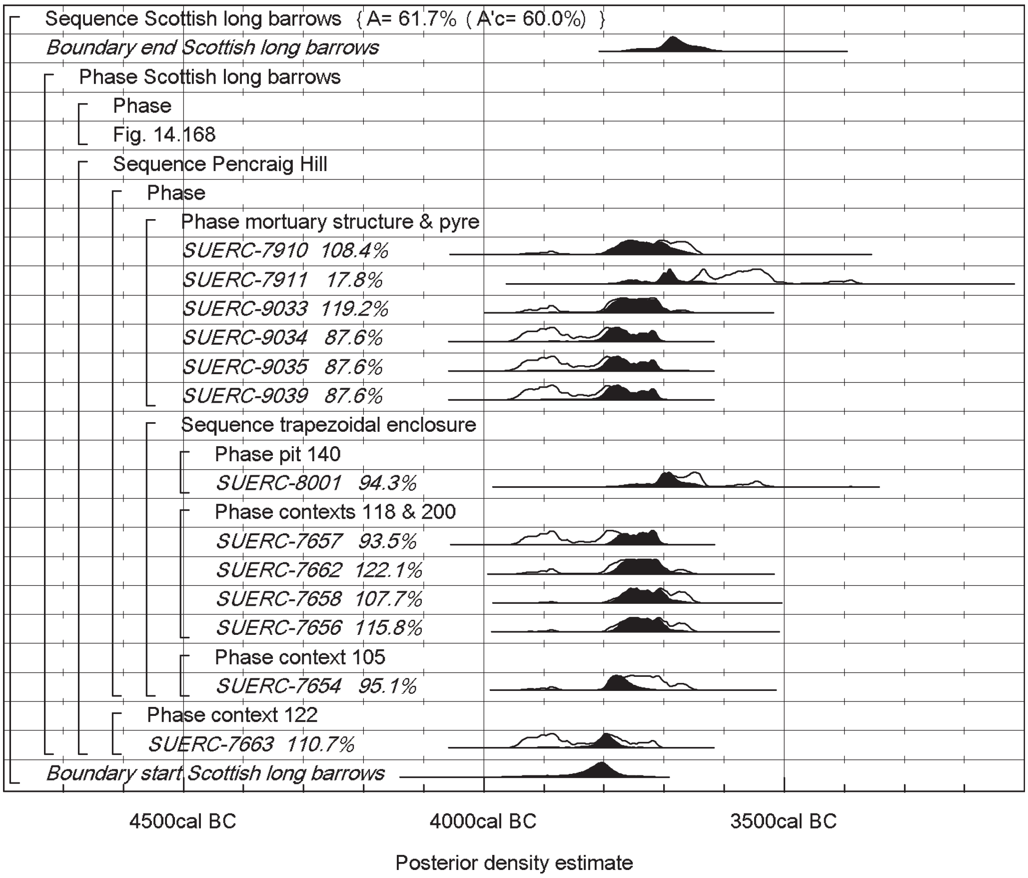


Fig. 14.167. Overall structure of the chronological model for early Neolithic long barrows in Scotland south of the Great Glen. The format is identical to that for Fig. 14.1. The component of the model is shown in detail in Fig. 14.168. The large square brackets down the left-hand side of Figs 14.167–8, along with the OxCal keywords, define the overall model exactly.

1992b) is even less secure – there being not a single date that is not a *terminus post quem*. For both of the dated sites, the latest date from beneath the mound provides a *terminus post quem* for construction of the mound. These are 3710–3380 cal BC (95% confidence; Table 14.14: SRR-684) for the mound at Boghead, and 3630–3350 cal BC

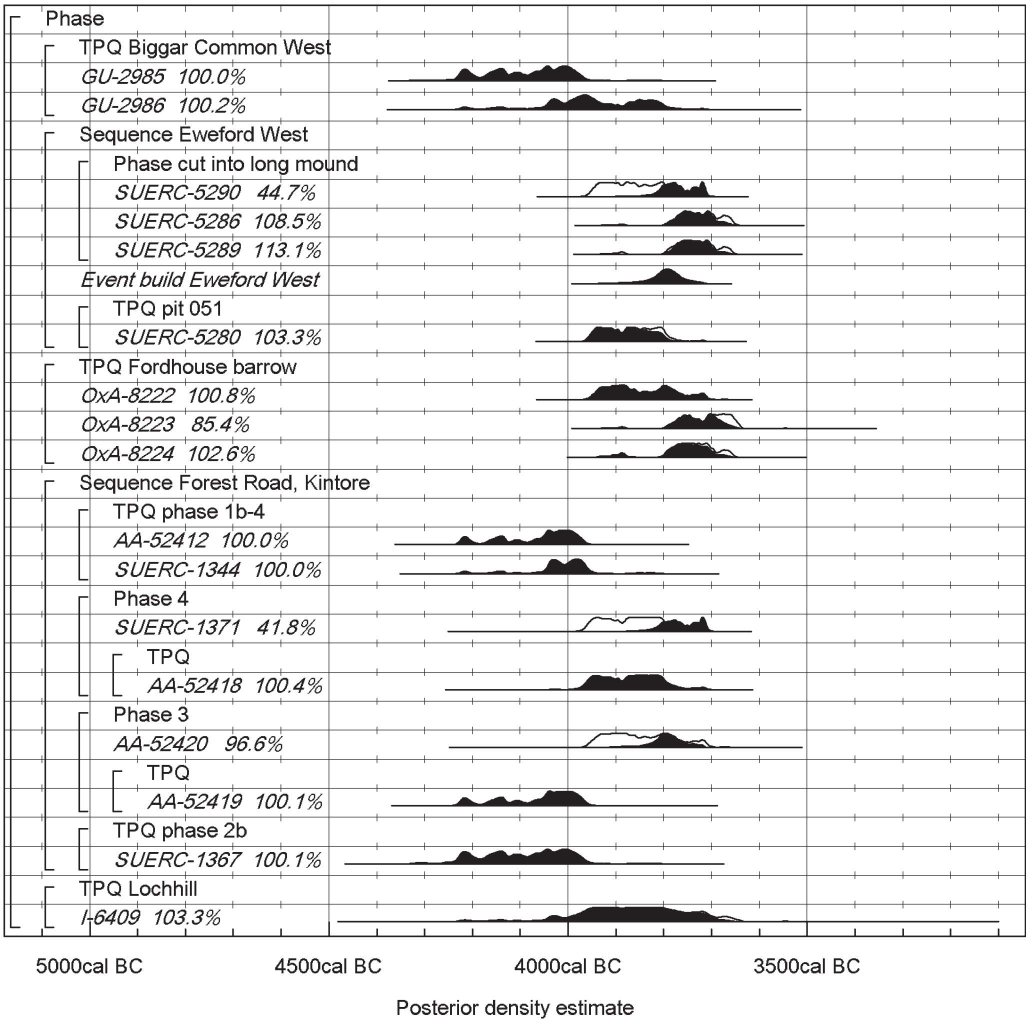


Fig. 14.168. Probability distributions of construction dates for samples associated with long barrows in Scotland south of the Great Glen. The format is identical to that for Fig. 14.1. The overall structure of this model is shown in Fig. 14.167.

(95% confidence; Table 14.14: GU-2049) for the mound at Midtown of Pitglassie. Again this monument type appears to fall in the middle centuries of the fourth millennium cal BC (Fig. 14.171).

Figure 14.172 shows a summary of our current chronology for early Neolithic monument types in Scotland south of the Great Glen. It is *77% probable* that the first Scottish long barrow predates the first chambered cairn, although given the limited sample of dates from chambered cairns it is difficult to say whether the stone chambered tradition really did follow on from the earthen and timber one. The dating of both the linear monuments and the non-megalithic round mounds currently leaves much to be desired, although such dating as exists at present would place these monuments in the middle centuries of the fourth millennium cal BC, along with Scottish chambered cairns, rather than with long barrows in the first centuries of the Scottish Neolithic.

Figure 14.173 shows a model for the chronology of rectangular timber halls in Scotland. Only three sites have dates: Balbridie, Claish and Crathes (at time of writing in early 2009, dates for fourth and fifth examples at Lockerbie Academy and Doon Hill[11] were still pending). In contrast to our approach to modelling these sites in estimating the date of the appearance of Neolithic things and practices (see above), this model treats all the dates from these timber halls as part of one continuous period of currency for the use of such structures. In this case, because we have exemplary series of dates from each of the structures, this is probably not the most realistic modelling approach. We have, however, adopted it so that our date estimates are directly comparable to those for Irish houses, where there are insufficient measurements from any one structure for a more sophisticated approach to be adopted. With these caveats, this model suggests that the currency of Scottish early Neolithic timber halls began in *3800–3705 cal BC* (*95% probability*; Fig. 14.173: *start Scottish houses*), probably in *3780–3725 cal BC* (*68% probability*). The currency of such halls ended in *3705–3630 cal BC* (*95% probability*; Fig. 14.173: *end Scottish houses*), probably in *3690–3645 cal BC* (*68% probability*).

It can be seen from Fig. 14.174 that the date estimates from the two approaches for modelling the chronology of early Neolithic timber halls in Scotland produce very similar results. The structures at the neighbouring sites of

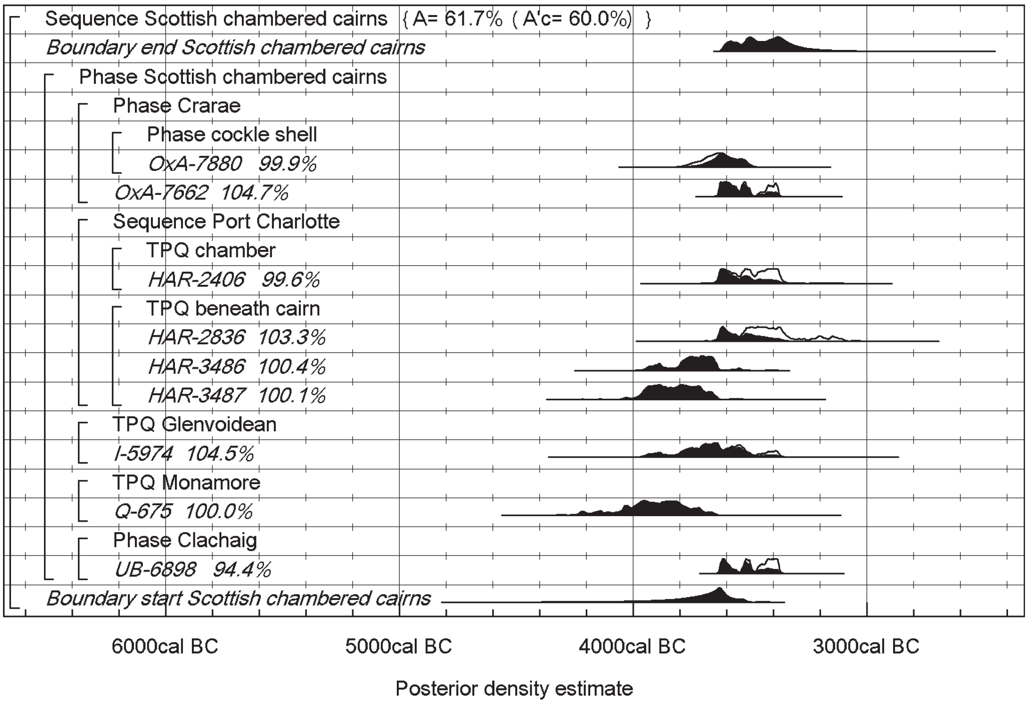


Fig. 14.169. Probability distributions of dates associated with chambered cairns in Scotland south of the Great Glen. The format is the same as for Fig. 14.1. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

Balbridie and Crathes seem to have been constructed in the first half of the 38th century cal BC. That at Crathes had probably gone out of use by the end of the century, but the structure at Balbridie seems to have been more enduring, standing until at least the middle of the 37th century cal BC. Claish, further south but with a strikingly similar ground plan to Balbridie (G. Barclay *et al*. 2002; Brophy 2007), is rather later, being constructed in the decades around 3700 cal BC, and being in use for around half a century.

A summary of our chronologies for the early Neolithic in Scotland south of the Great Glen is shown in Fig. 14.175. The first Neolithic things and practices arrived across lowland Scotland in the decades around 3800 cal BC.[12] Carinated Bowl, including both the traditional and North-East variants, was a component of this primary Neolithic activity. Monuments, specifically long barrows and variant forms, were also a primary component of this first Neolithic activity. Possibly a generation or two later came the first timber halls, and modified Carinated Bowl, during the course of the 38th century cal BC. The currencies of both halls and long barrows were relatively brief, probably ending in the first half of the 37th century cal BC. Around this time may come the first chambered cairns, linear monuments and non-megalithic round mounds, though the dating of none of these is entirely satisfactory. The end of both traditional and North-East variants of Carinated Bowl appears to fall in the last decades of the 37th century cal BC, although modified Carinated Bowl may continue in use during at least the 36th century cal BC. Our models for the general currency of Carinated Bowl include a disproportionate number of samples associated with traditional Carinated Bowl. Further dates on the other variants would be most welcome. Our dates for the end of the early Neolithic in this part of Scotland are heavily correlated with our date estimates for Carinated Bowl. There do not appear to be equivalents of southern Decorated Bowl in lowland Scotland, the nearest approximation being fluted linear decoration on some North-East Carinated Bowl (e.g. Sheridan 2007a, fig. 10). We also note Beacharra Ware in the west and Unstan Ware in the far north. Our date estimates may imply that Impressed Wares in Scotland followed on from modified Carinated Bowl.

14.8 Wider histories: the development of the early Neolithic in Britain and Ireland

We can now attempt to place causewayed and related enclosures on a much wider stage. Figure 14.176 provides a summary of the first appearance of Neolithic things and practices in the different parts of Britain and Ireland covered in this project. The Neolithic did not appear everywhere at once (Fig. 14.177) and the pace of its coming varied.

In south-east England, the first elements of the Neolithic appeared in the 41st and 40th centuries cal BC (Figs 14.176 and 14.57). Here, the first centuries of the Neolithic included Carinated Bowl, as at Yabsley Street, Blackwall (Fig. 14.49), with large rectangular timber houses, as at White Horse Stone (Fig. 7.26), monumental constructions such as the large megalithic chamber at Coldrum (Fig. 7.27), and flint mines in Sussex (Fig 5.33) appearing within a few generations. At White Horse Stone cereals were part of this first Neolithic with both wheat and

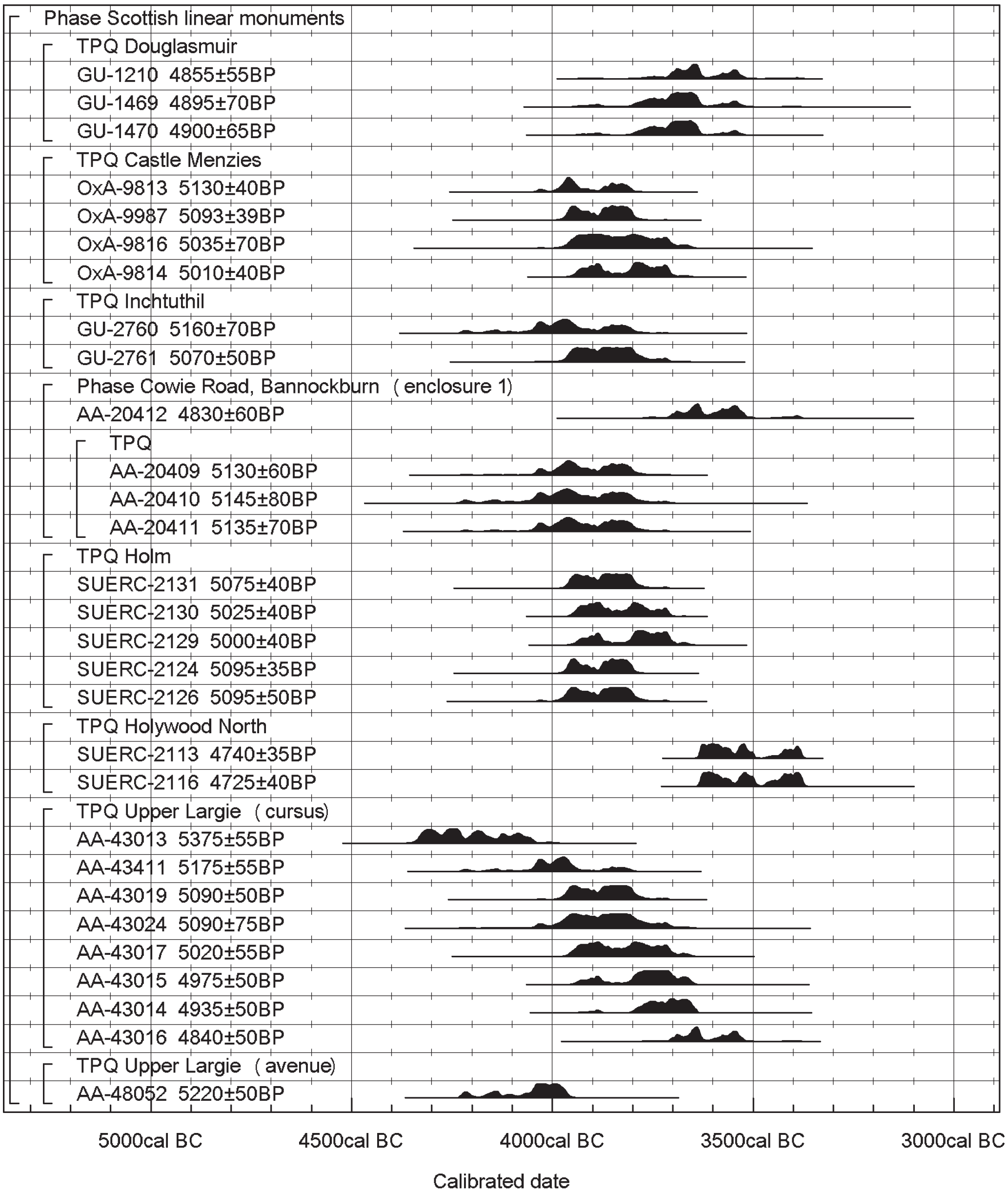


Fig. 14.170. Calibrated radiocarbon dates (Stuiver and Reimer 1993) for samples associated with linear monuments in Scotland south of the Great Glen.

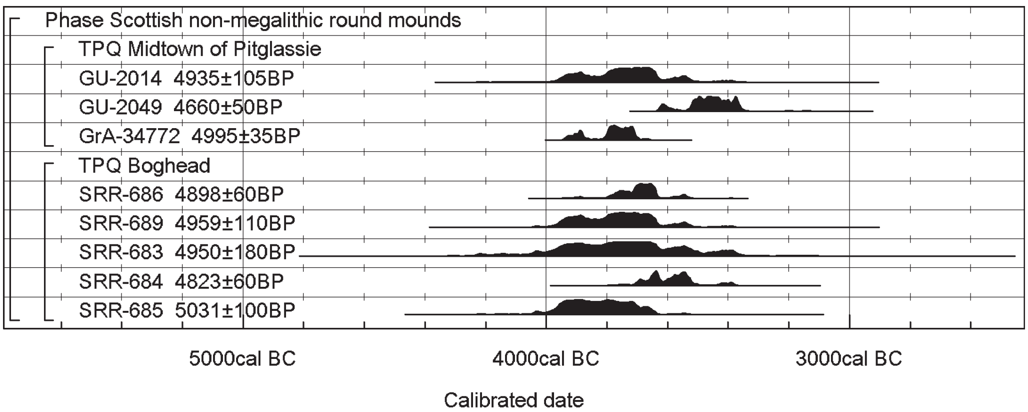


Fig. 14.171. Calibrated radiocarbon dates (Stuiver and Reimer 1993) for samples associated with non-megalithic round mounds in Scotland south of the Great Glen.

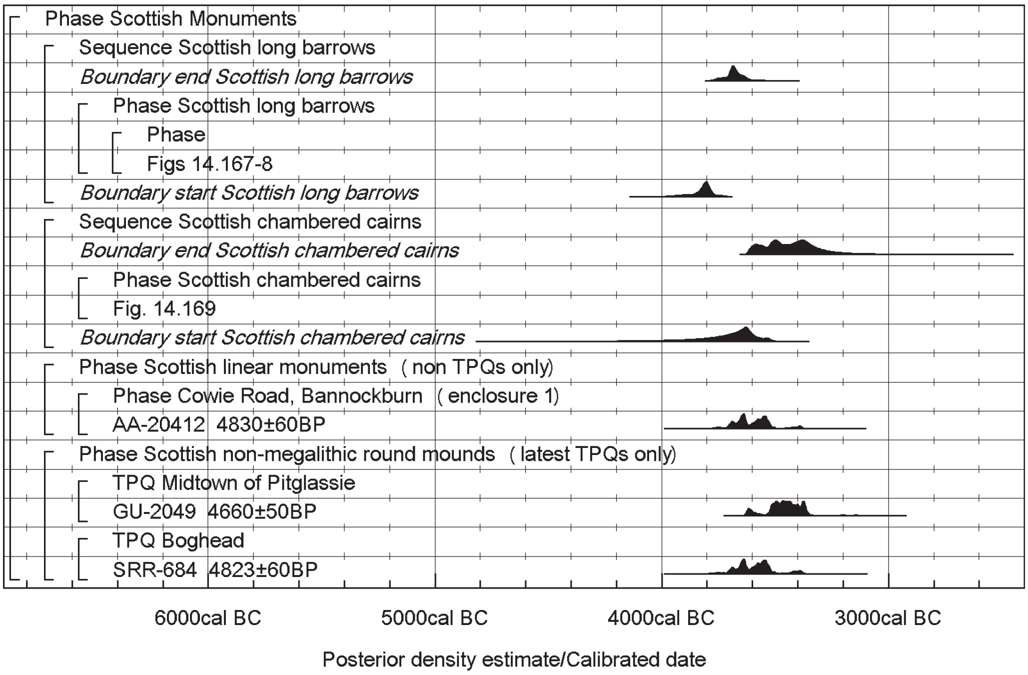


Fig. 14.172. Probability distributions for the currency of different types of early Neolithic monument in southern and north-east Scotland, derived from the models shown in Figs 14.167–8 and 14.169, and from selected calibrated dates shown on Figs 14.170–1.

unidentified cereal grains being directly dated to these earliest years of the British Neolithic (Table 7.6). Pottery was present from the beginning (Figs 14.80–1), although it may have been two or three generations before the first monument was constructed (Fig. 14.82). At this stage, we have no evidence for 'classic' early Neolithic monument types such as long barrows and causewayed enclosures, no certain evidence for other styles of Bowl pottery, no certain evidence for domesticated fauna (although a single cattle tooth from White Horse Stone (http://ads.ahds.ac.uk/catalogue/projArch/ctrl/bfw98/ may be such), and no evidence for the use of stone axeheads. Such absence of evidence is not evidence of absence, and it is salutary to note that three of the key sites have been investigated or dated only in the last five years, so that this picture may change substantially.

In south-central England, the first Neolithic things and practices appeared in the later 40th or early 39th century cal BC (Figs 14.176 and 14.57), *30–205 years* (*95% probability*; Fig. 14.178: *SE/S central*) after they appeared in south-east England, probably *80–165 years* (*68% probability*). Here, primary elements of the Neolithic included Carinated Bowl, cereals, and domesticated fauna (sheep, cattle and pig), as beneath the monuments at Ascott-under-Wychwood and Hazleton (Fig. 9.29). Beneath both, there were also small or ill-defined timber structures. The large rectangular timber house at Yarnton may date a few generations later, but also belongs to these first centuries of the Neolithic in this area (Fig. 8.27). Early occurrences of plain Bowl pottery and a non-local polished flint axehead, as at Fir Tree Field (Fig. 4.21), similarly belong to these centuries, but may not be evidence that these elements were absolutely primary in the appearance of the Neolithic in this area. At this stage, it is not clear whether long barrows form a primary element or whether they appear two or three generations later (Figs 14.80, 14.82). Sites such as Burn Ground (Fig. 9.27) certainly seem to have been constructed in the early centuries of the Neolithic in the Cotswolds. Causewayed enclosures, Decorated Bowl pottery and stone axeheads do not seem to have been part of this earliest phase in south-central England.

There is some evidence that this comparatively broad-scale analysis of the chronology of the earliest Neolithic in south-eastern Britain may be masking interesting regional variation (Fig. 14.54). Even within the areas considered, Neolithic things and practices may not have appeared all at once (*start Thames estuary* is more than a century earlier than *start eastern Neolithic*, for example: Fig. 14.54). The general trajectory of change from south-east to north-west across Britain may conceal a more complicated process. For example, *start Cotswold Neolithic* is rather earlier than might be expected if a rigid spatial trend is sought (Fig. 14.54). We have chosen to present our wider spatial analysis in the discussion here, because we are not entirely convinced that we yet have sufficient data to be sure that the more refined spatial analysis is reliable.

Figures 14.176–8 show that there was around a century between the first appearance of Neolithic things and practices in the south-east corner of England and their appearance in south-central England. It took this time for the new practices to spread over a distance of perhaps 100 km. In the decades around 3800 cal BC, the pace of change accelerated dramatically. Over a period of two or three generations, the first Neolithic things and practices appear

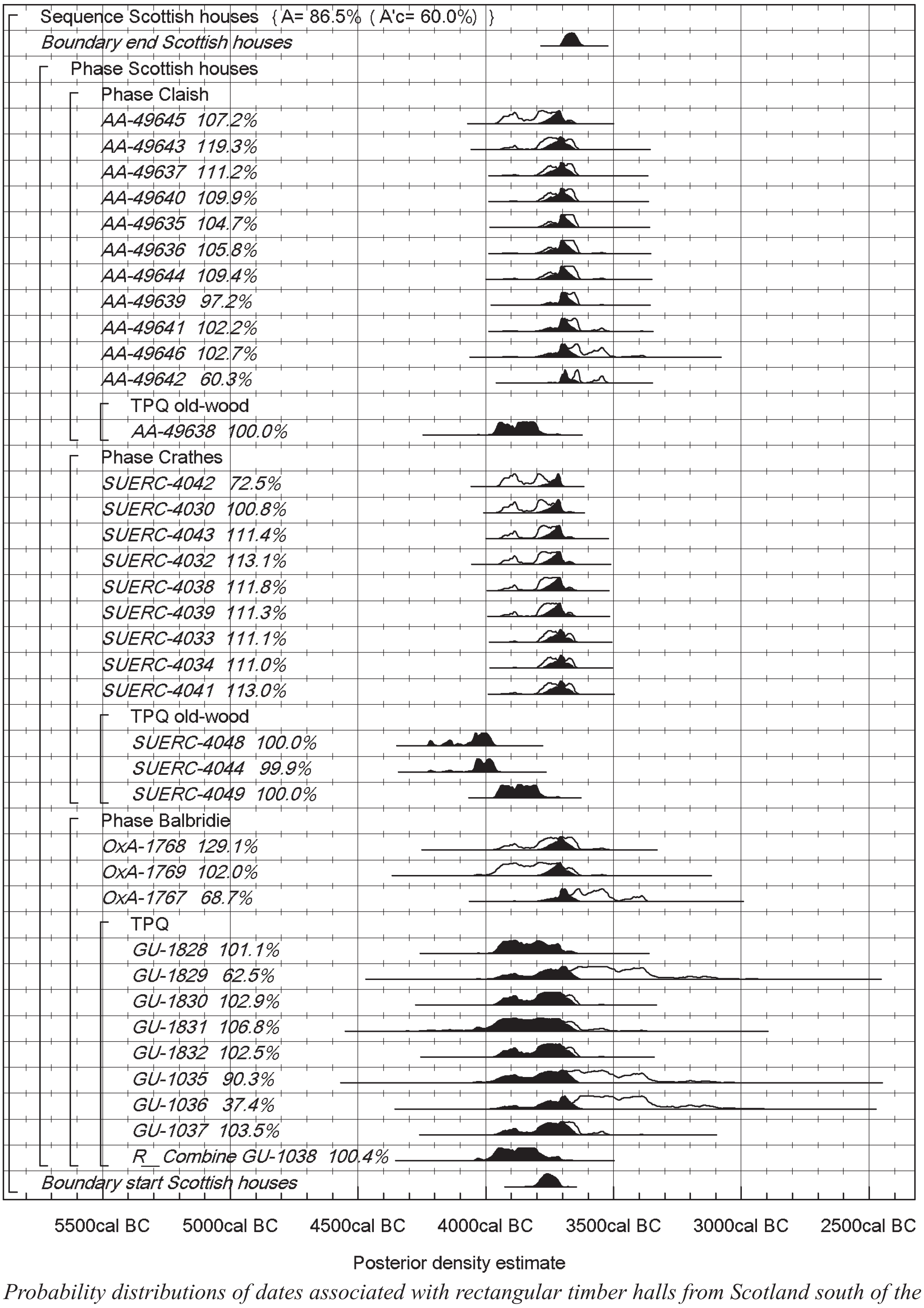


Fig. 14.173. Probability distributions of dates associated with rectangular timber halls from Scotland south of the Great Glen. The format is the same as for Fig. 14.1. The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the overall model exactly.

over a very wide area, from southern Cornwall to north-east Scotland: a distance of some 600 km from the northern edge of what we have defined as south-central England to the Moray coast.[13] Was the character of this high-speed Neolithic the same as that of earlier centuries?

In south-west Britain, the first Neolithic things and practices appeared in the later 39th or earlier 38th century cal BC (Figs 14.176 and 14.57), *15–205 years* (*95% probability*; Fig. 14.178: *S central/SW*) after they appeared in south-central England, probably *55–150 years* (*68% probability*). Here, primary elements of the Neolithic included Carinated Bowl, as at Broadsands (Fig. 10.30), and probably South-Western style pottery (Figs 14.80–1). In this area, monuments are present from the very beginning, although enclosures (causewayed and stone-walled) are not (Fig. 14.83). Rectangular timber houses, like that at Penhale Round (Fig. 10.30), also belong to the initial Neolithic in the south-west, as do cereals and domesticated fauna, as

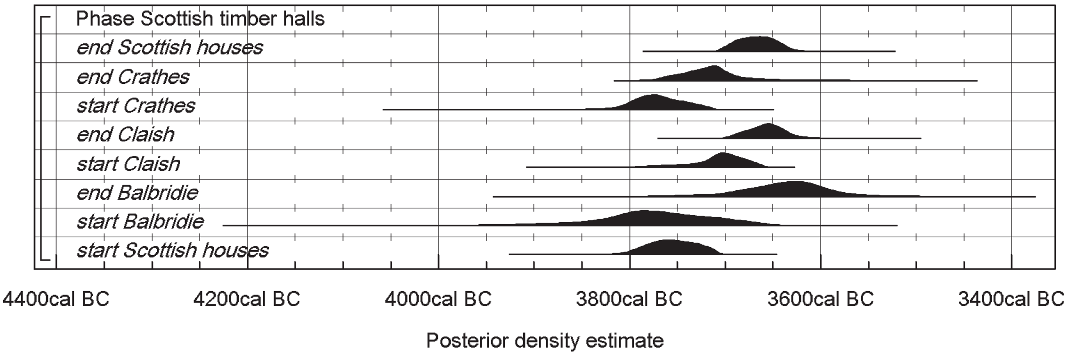


Fig. 14.174. Probability distributions of dates for the currency of early Neolithic timber halls in Scotland and for the construction and demolition of particular structures, taken from the models defined in Fig. 14.173, 14.150–3 and 14.154–7.

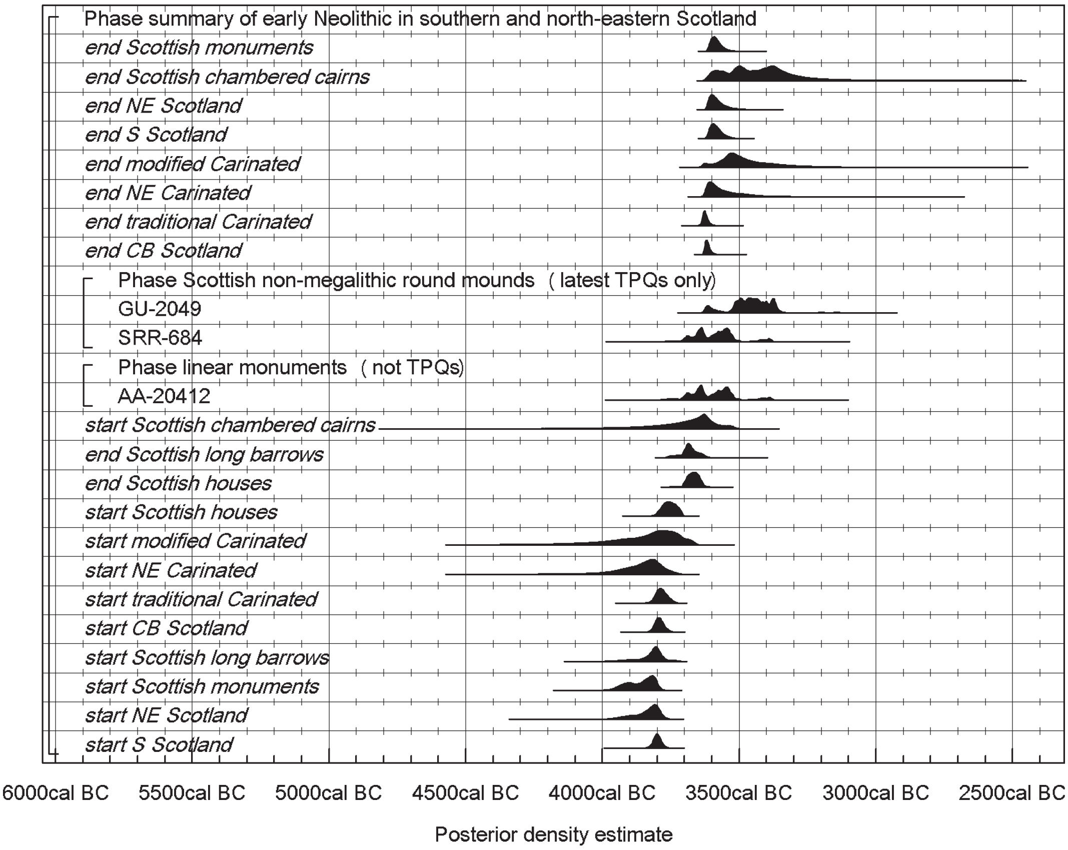


Fig. 14.175. Probability distributions of dates for entrances and exits of early Neolithic things and practices in southern and north-eastern Scotland, taken from the models defined in Figs 14.150, 14.154, 14.158, 14.159, 14.163, 14.164, 14.166, 14.167, 14.169 and 14.173 (with their component parts where appropriate), and from selected calibrated radiocarbon dates shown in Figs 14.170 and 14.171.

at Penhale Round and Broken Cavern respectively (Fig. 10.30). Ground stone axeheads, however, do not appear to be present in this earliest phase (Figs 14.119–21).

By this date, the decades around 3800 cal BC, a wider set of things and practices were included when the first Neolithic presence appeared in an area. We do not know which elements appeared with the first Neolithic on the Isle of Man, as the dating evidence is currently severely restricted (Fig. 14.148). Barley, plain Bowl pottery and ground stone axeheads were, however, present (Table 11.5).

Frankly, we do not know the date when the first Neolithic things and practices appeared in Ireland. The data are contradictory. On the one hand, we have a large and coherent series of dates which suggest the first appearance of the Neolithic in Ireland sometime within the 38th century cal BC (Fig 14.176). On the other, there is the dating of the causewayed enclosure at Magheraboy (Fig. 12.15), which is stubbornly 200 years earlier than the rest of the evidence. Magheraboy is not just a single monument with a potentially anomalous date, because the earliest contexts at that site bring with them an assemblage of other things and practices, comparable to those found in later centuries

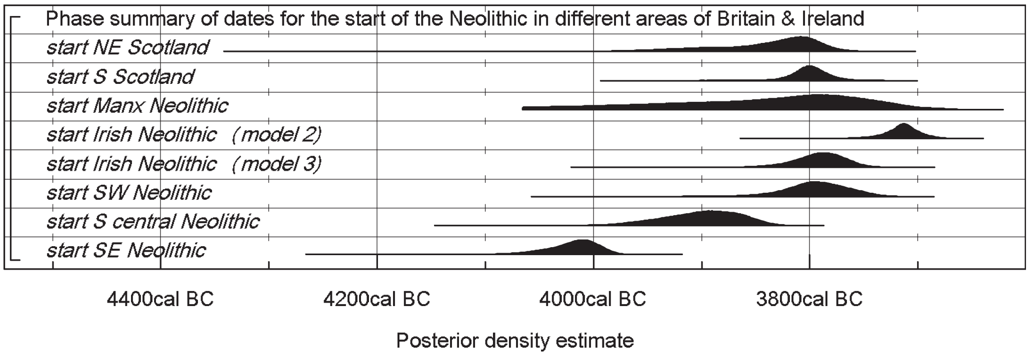


Fig. 14.176. Probability distributions of dates for the first appearance of early Neolithic things and practices in areas of Britain and Ireland, taken from the models defined in Figs 12.54, 12.56, 14.57, 14.148, 14.150 and 14.154 (with their component parts where appropriate).

in the early Neolithic in Ireland. We can now consider competing interpretations of this evidence in the light of the emerging picture of the process of Neolithisation across Britain and Ireland as a whole.

The spatial and time-transgressive trend evident for the appearance of the first Neolithic in Figs 14.176–7 in our view adds plausibility to the date estimate for the introduction of such practices into Ireland provided by model 3 (described in Chapter 12; Fig. 12.56). We suggest that model 2 (Fig. 12.54) may be biased by a disproportionate number of samples from the apparently short-lived house phenomenon in Ireland, and that a representative sample of dates on short-life samples firmly associated with the whole range of early Neolithic things and practices on the island would provide date estimates more in line with those currently provided by model 3. We note, for example, that the model for the chronology of other early Neolithic occupation in Ireland (Fig. 12.30) suggests that such activity begins in *4000–3700 cal BC* (*95% probability*; Fig. 12.30: *start other early Neolithic*), probably in *3840–3725 cal BC* (*68% probability*).

It is possible to shoehorn the existing dating for Magheraboy into this picture (Fig. 12.59) but it takes some forcing! The problem is that it is hard to interpret Magheraboy as the product of an early, different, episode of Neolithic contact up the west coast of Ireland, as has been argued for example for the very early domesticated fauna at Ferriter's Cove (e.g. Sheridan 2007a). The Carinated Bowl from the segmented ditch is in no way out of the ordinary for such assemblages in Ireland (Danaher 2007). The porcellanite axehead from the ditch also fits well in the wider spectrum of Group IX products. But this is at the heart of the Magheraboy problem, since there is no other evidence for the use of the Tievebulliagh and Rathlin Island sources so early, and we have already presented the evidence (this chapter, above) from elsewhere in western Britain for the appearance of exchange networks which involved the longer-range movement of stone axeheads at a substantially later date: from the first half of the 37th century cal BC (Fig. 14.134: *start stone axe networks*). In the light of all this, we consider that the special pleading that we fully acknowledge is required to coerce the Magheraboy dating into line with the rest of the early Neolithic in Ireland may be justified. This situation is obviously unsatisfactory and its resolution requires further research. Meanwhile we will go on with our discussion of Ireland favouring model 3, as the most plausible chronology for the appearance of the Neolithic there given the current contradictory nature of the evidence.

On this basis, the first century of the Neolithic in Ireland may include the presence of Carinated Bowl pottery (Table 12.4) and also the extraction of porphyry for axehead manufacture on Lambay Island (Fig. 12.30). Domesticated fauna were also certainly present (Fig. 12.42). It is possible that court tombs (Figs 12.23–4) and other monuments (Fig. 12.35) could start this early, although here we run up against the limitations of the available dating. The imprecision of our current date estimates also means that we cannot tell whether the establishment of the Céide Fields occurred right at the start of the Neolithic. At present, we have no certain instances of Carinated Bowl, porcellanite axeheads or cereals in Ireland before the appearance of rectangular timber houses, a tradition which clearly begins at least several generations after the start of the Neolithic in Ireland. The causewayed enclosure at Donegore may also have been established in the later 38th century cal BC, although again our dating is rather imprecise. On the basis of the published evidence, we do not accept the assertion that the passage tombs at Carrowmore have such early origins (Fig. 12.50). Portal tombs are almost entirely undated, but given our preferred interpretation of the varied dates now available from Poulnabrone (Fig. 12.31), these may now belong later in the fourth millennium cal BC.

In Scotland, a clearer pattern emerges. In southern Scotland (as defined above), the first Neolithic things and practices appeared within a generation of 3800 cal BC (Figs 14.150, 14.176). These included traditional Carinated Bowl, as at Brownsbank Farm, Biggar, cereals, as at Carzield, and long barrows, as at Eweford West. There is no evidence for North-East Carinated Bowl in this area, or for modified Carinated Bowl this early. Chambered cairns and linear monuments may belong to a slightly later period within the early Neolithic in the area. Only one timber hall has been dated in southern Scotland, the Claish structure

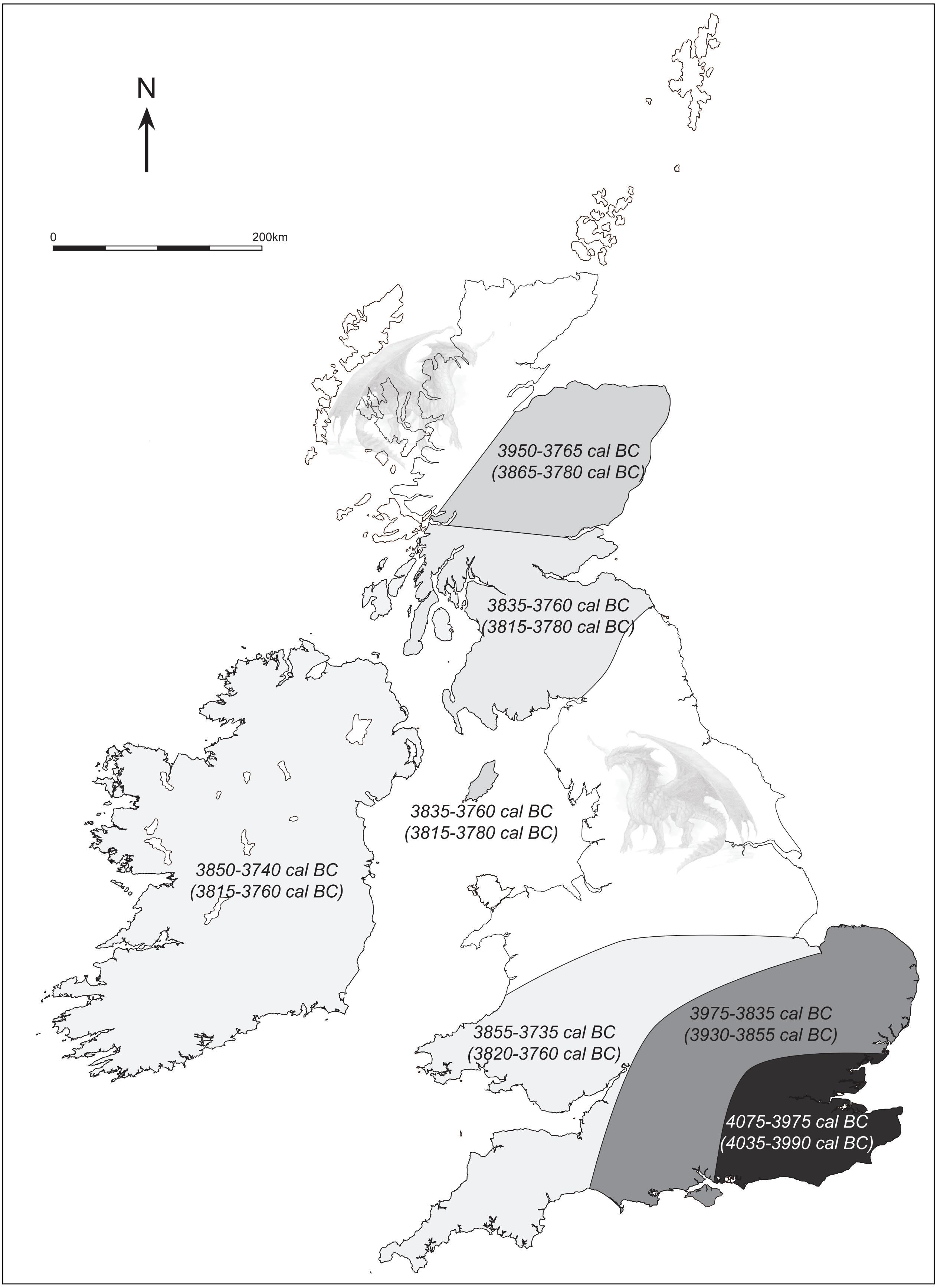


Fig. 14.177. Map showing date estimates for the start of Neolithic activity area by area across Britain and Ireland, at 95% probability (68% probability in brackets). Dragons lurk over areas not modelled in this study.

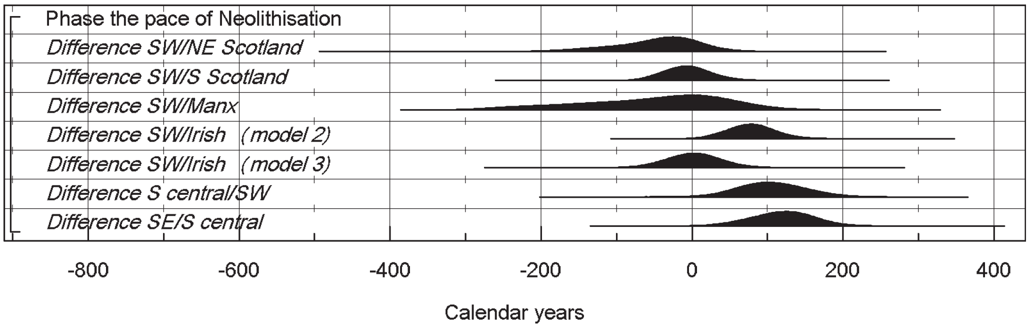


Fig. 14.178. Intervals between the appearance of the first Neolithic things and practices in different areas of Britain and Ireland, calculated from the distributions shown in Fig. 14.176.

not dating to the first generations of the Neolithic but belonging in the later part of the currency of such timber halls in Scotland (Fig. 14.174).

The first Neolithic appeared in north-east Scotland at very much the same time as it appeared farther south (Figs 14.154, 14.176 and 14.178), although there are fewer data and so our date estimate is less precise. Here, the first Neolithic included timber halls at Balbridie and Crathes, associated with North-East and traditional Carinated Bowl respectively. Wheat, barley, oats and flax were associated with the Balbridie hall, and barley was found in pits of similar date at Garthdee Road. Modified Carinated Bowl appears at this time at Dubton Farm, and a long barrow at Forest Road, Kintore, also dates to this primary phase. There is, however, no evidence that chambered cairns, linear monuments, or non-megalithic round mounds belong this early.

So were there differences between the elements of the Neolithic that appeared in south-east England in the century of so after *c*. 4050 cal BC, and those that appeared across a wide swathe of western and northern Britain, and in Ireland too, in the decades around 3800 cal BC? The presence or absence of different aspects of the Neolithic as part of the initial Neolithic activity in each of the areas considered in this analysis is shown in Fig. 14.179. Bearing in mind that the date of this first Neolithic varies across Britain and Ireland, some patterns emerge. Pottery appears to be an element of the primary Neolithic everywhere and, although the evidence is slightly more patchy, it is probable that cereals and domesticated fauna were too. Across the entire study area, except possibly the Isle of Man (Burrow 1997; Darvill 2004d, 40), it seems that Carinated Bowl formed at least a component of the earliest pottery assemblages.

There was thus a Neolithic 'package', but at first it was an accretive one (Fig. 14.179). In south-east England, where dated Neolithic elements are first perceptible, their appearance may be staggered, with perhaps both monuments and rectangular structures not appearing in the first generations. In south-central England, too, monuments may appear a generation or two after the first Neolithic practices. By the time the Neolithic spread to south-west Britain, Ireland, and Scotland south of the Great Glen, in the decades around 3800 cal BC, the 'package' had been assembled. In Ireland the dated cattle bone from a culturally Mesolithic context at Ferriter's Cove and the exceptionally early date of the Magheraboy enclosure stand apart from all our other estimates. If the former is regarded as a pre-Neolithic introduction (Chapter 12) and the latter held in suspense as meriting further investigation (Chapter 12 and above), then the other elements seem to be adopted all at once in Ireland, as in south-west Britain and Scotland south of the Great Glen. The exceptions are rectangular houses, which in both Ireland (in our preferred model 3) and Scotland (but not in the south-west peninsula) appear slightly after the first Neolithic things and practices, and polished stone axes, which everywhere may appear slightly later. Are these two bound up with the exchange networks which appear in all the three regions of southern Britain which we have examined in the decades when both enclosures and Decorated Bowl pottery appear?

Monumentality is not necessarily part of the first appearance of the Neolithic everywhere. In south-east and south-central England, the first monuments may have appeared two or three generations after the initial Neolithic (Fig. 14.82). In the 40th century cal BC, in south-east England, the first constructions were not necessarily of forms that later became recurrent. Elsewhere, as far as we can tell, long barrows and cairns (and timber variants on this idea: Sheridan 2006a), and court tombs in Ireland, may have been the first monuments to be built. Except possibly in Ireland, in all areas where they are present, causewayed and stone-walled enclosures were not among the first monuments. Rectangular timber structures may be part of the initial southern English Neolithic, or at least only a generation or two removed, although in Ireland and perhaps also in Scotland (where only three buildings are included in the analysis), houses appear to form concentrated horizons post-dating the first Neolithic presence.

Fig. 14.180 summarises the available dates for rectangular timber structures in Britain and Ireland. Further dating is under way for Lockerbie Academy in Dumfries and Galloway (Oliver Harris, pers. comm.), Doon Hill A (Ian Ralston, pers. comm.), Parc Bryn Cegin near Llandygai (Kenney and Davidson 2006),[14] Parc Cybi on Anglesey (Jane Kenney, pers. comm.), Horton in Berkshire (Pitts 2008; Alistair Barclay, pers. comm.), and Lismore Fields in

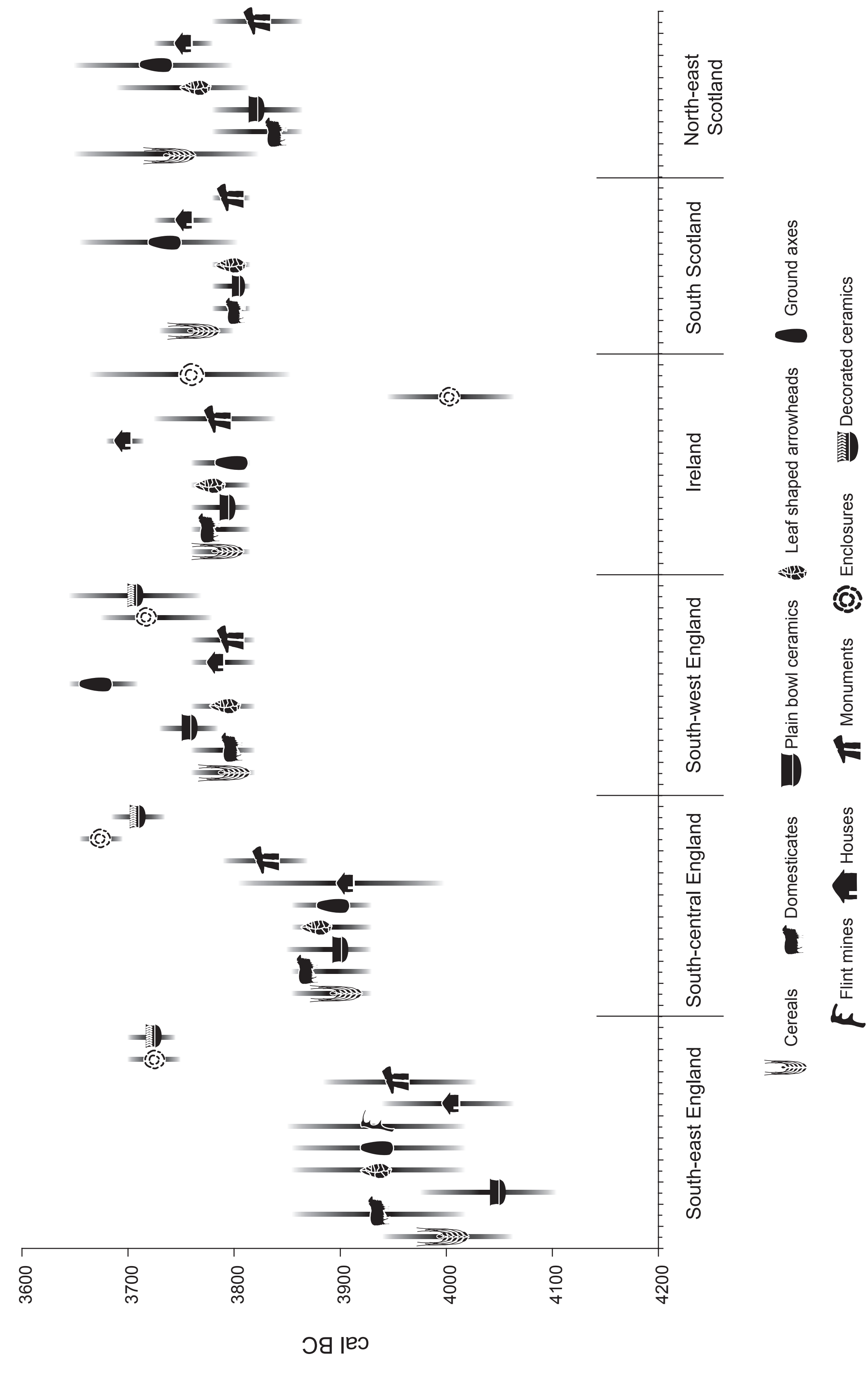


Fig. 14.179. Schematic diagram showing date estimates for the appearance of Neolithic things and practices across selected areas of Britain and Ireland.

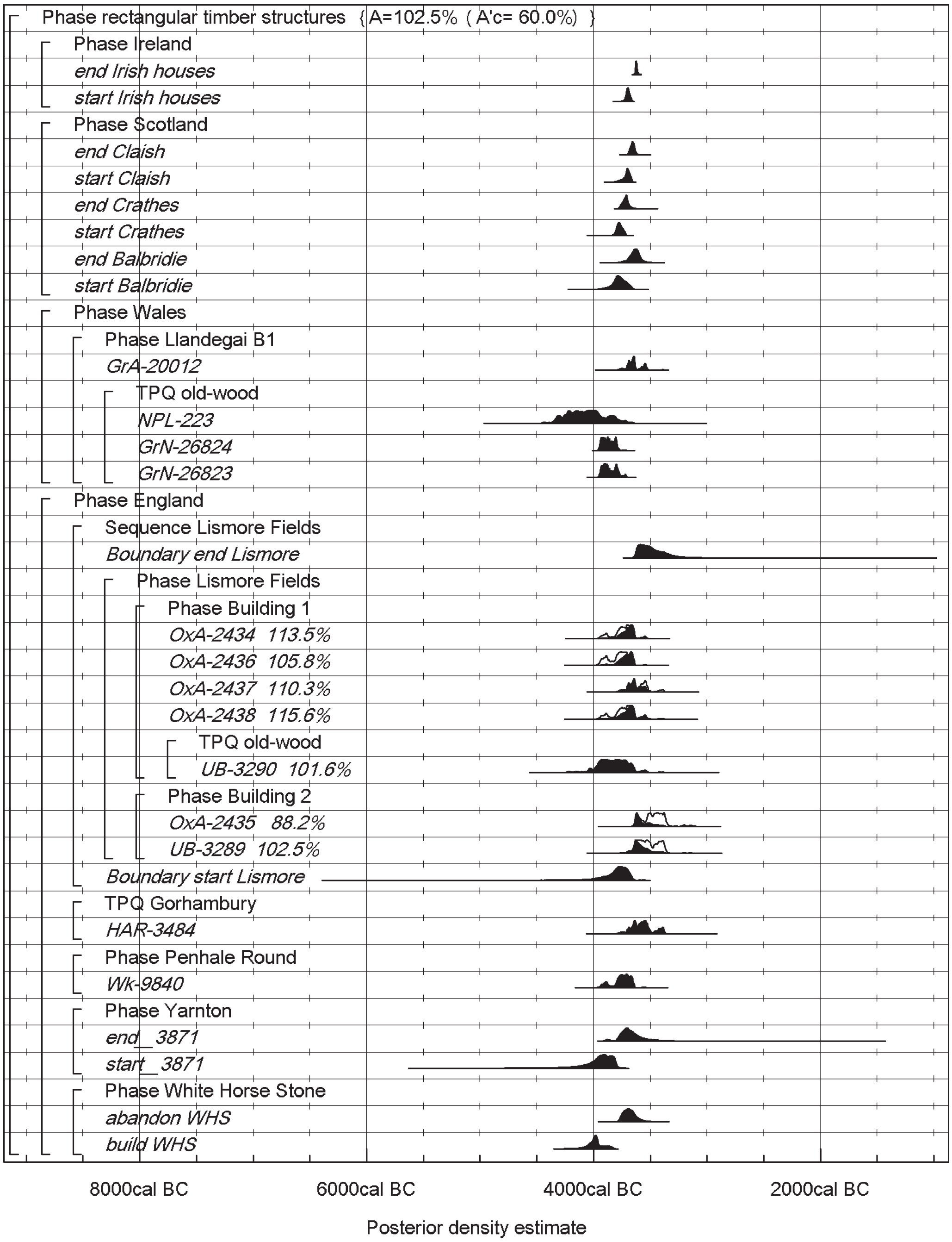


Fig. 14.180. Probability distributions of dates associated with rectangular timber structures in Britain and Ireland. The format is the same as for Fig. 14.1. Distributions have been taken from the models defined in Fig. 7.26 (White Horse Stone), Fig. 8.27 (Yarnton), Figs 12.22–7 (Irish houses), Figs 14.150–3 (Claish) and Figs 14.154–7 (Balbridie and Crathes). The large square brackets down the left-hand side of the diagram, along with the OxCal keywords, define the model exactly.

Derbyshire (Daryl Garton, pers. comm.), so that this picture will be refined in the near future. The existing Lismore Fields dates are listed in Table 14.15. The relatively few British buildings contrast with the numerous Irish ones in their larger size, many of them exceeding 20 m in length, while the Irish buildings cluster between 6 m and 14 m in length, with few outliers (Smyth 2006, fig. 5). The British buildings are of varying dates, ranging from the large timber hall at White Horse Stone, probably built in the 41st or 40th century cal BC, at the beginning of the Neolithic in Kent, to the even larger halls built in Scotland from the 38th century cal BC. The smaller Irish houses are different, apparently built and used in a restricted period of time between the decades around 3700 cal BC and *c.* 3625 cal BC (Figs 12.22–7). It is possible that the houses in north Wales and at Lismore Fields have more in common with the Irish tradition and fall within its currency.

In the decades around 3800 cal BC Neolithic things and practices first appeared over large areas of western and northern Britain and, we have suggested, in Ireland too

Table 14.15. Radiocarbon dates from rectangular structures at Lismore Fields, Derbyshire.

Laboratory Number	**Description**	**Radiocarbon Age (BP)**	**$\delta^{13}C$ (‰)**	**Calibrated date range (cal BC) (95% confidence)**	***Posterior density estimate (cal BC)* (*95% probability*)**
Building I. Rectangular, 15.75 m by 5.35 m. Post built, some slots, 3 internal divisions					
OxA-2434	*Triticum* sp. grains from context 0089, postpipe, Building I	4930±70		3940–3530	*3810–3625* (*92%*) or *3585–3530* (*3%*)
OxA-2436	*Linum usitatissimum* seeds from context 0110, post-pipe, Building I	4970±70		3960–3630	*3910–3870* (*2%*) or *3845–3630* (*93%*)
OxA-2437	*Corylus* charcoal from context 0015, post-pipe, Building I	4840±70		3770–3380	*3765–3515*
OxA-2438	*Triticum* sp. grains and *Corylus* charcoal from posthole 0103 subsidence, Building I	4920±80		3950–3530	*3810–3615* (*87%*) or *3610–3525* (*8%*)
UB-3290	*Corylus*, *Fraxinus*, *Sorbus* and *Populus* charcoal from posthole 0138 subsidence, Building I	5024±126	−26.4	4050–3530	*4070–3625* (*94%*) or *3585–3535* (*1%*)
Building II. Rectangular, 7.7 m by 5.5 m. Post built, 1 internal division					
OxA-2435	*Corylus* and *Crataegus* charcoal from postpipe and subsidence below deliberate backfill in posthole 0238	4680±70		3640–3340	*3650–3395*
UB-3289	*Quercus* charcoal from postpipe below deliberate backfill in posthole 0275	4745±88	−25.7	3700–3350	*3705–3480* (*88%*) or *3475–3400* (*7%*)

(Fig. 14.176). In southern Britain the pace of change seems to have intensified markedly during the 38th century cal BC (Fig. 14.140). Was this also true elsewhere? Was this new Neolithic more dynamic than that which had come before? In Ireland, the enclosure at Donegore may have been constructed during the later 38th century cal BC or during the first decades of the 37th, and within a generation of 3700 cal BC came a veritable flood of houses (Fig. 14.181). In Scotland there is less evidence of innovation in the course of the 38th century; instead, the new practices all seem to have appeared at the same time, at the start of the century. Timber halls may be the exception (Fig. 14.181), as they may have been begun to be built a generation or so after the establishment of other Neolithic practices, although only three have so far been dated.

Figure 14.182 shows in greater detail the innovations witnessed by the generations of people who lived around 3700 cal BC. Although Donegore is imprecisely dated, it could be contemporary with the introduction of enclosures into southern Britain. This occurred at the same time as the emergence of Decorated Bowl and of gabbroic fabrics. Cleal (2004, 80) has already concluded that ‘there is no evidence … that Gabbroic Ware appears earlier than around the same time as the appearance of the causewayed and “tor” enclosures . . . . The occurrence of this true ‘Ware’ (i.e. style and fabric indicating a common source) is such a striking novelty that it suggests . . . a sizable shift in the way society was organised at around this time’. These innovations of the later 38th century were swiftly followed by further change in the succeeding decades. It is *90% probable* that the first enclosure in southern Britain predates the start of the Irish house phenomenon. This began around a generation later, at the time when intensive construction of enclosure circuits began (Fig. 14.183). This is also the time when extensive networks are first apparent within Britain, with the long-distance transport of stone axeheads and gabbroic pottery (Fig. 14.181). Full analysis and publication of Ballygalley, with its four houses, will clarify how far this phase relates to the various strands of evidence which have prompted the interpretation of the site as a redistribution centre for local and imported materials (D. Simpson 1996, 132). Their rapid appearance during the 37th century cal BC mirrors the first intensive period of causewayed enclosure construction in southern Britain (Fig 14.22). Were these contemporary phenomena linked? Did they both stem from similar changes in society on both sides of the Irish Sea which occurred during the 38th century cal BC?

If these practices had a common origin, they did not have a common demise. Figure 14.184 shows the dates when some of the traditions that had appeared in the early centuries of the Neolithic came to an end. Carinated Bowl pottery, at least its traditional and north-eastern variants, ceased to be made in Scotland in the decades just before

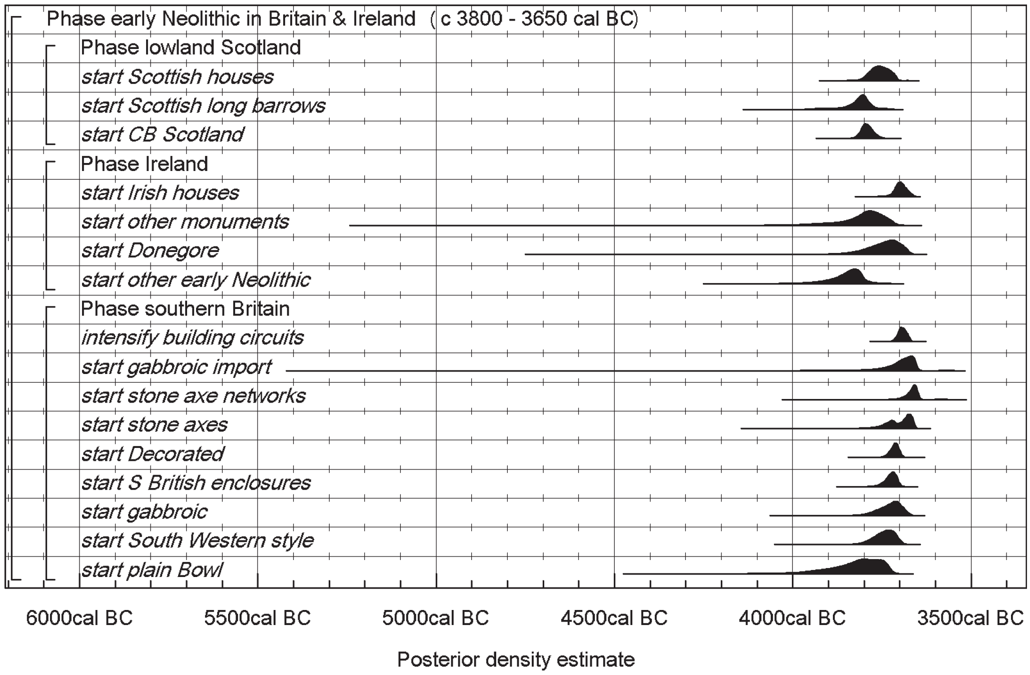


*Fig. 14.181. Probability distributions of dates for the appearance of novel things and practices in Britain and Ireland (*c. *3800–*c. *3650 cal BC), taken from the models defined in Figs 12.5, 12.22, 12.30, 12.35, 14.1, 14.7, 14.92, 14.101, 14.104, 14.119, 14.134, 14.137, 14.158, 14.167 and 14.173 (with their component parts where appropriate).*

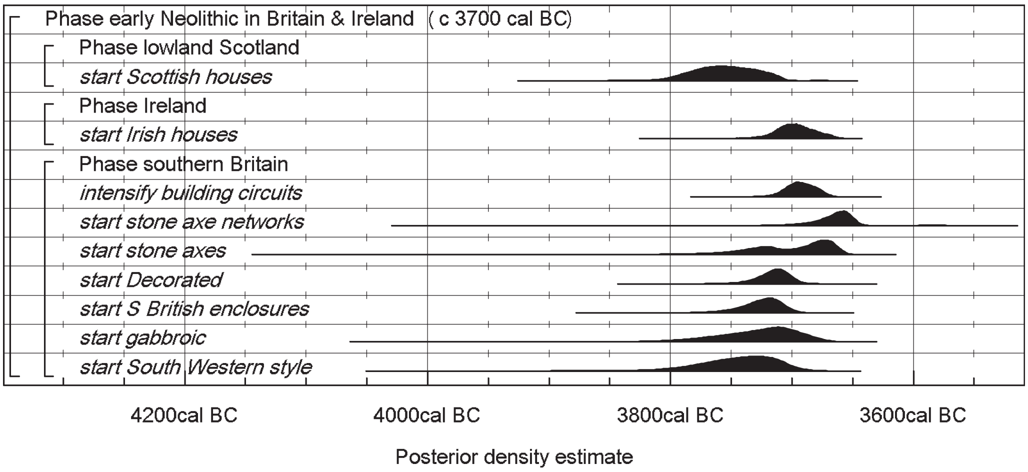


Fig. 14.182. Probability distributions of dates for the appearance of novel things and practices in Britain and Ireland in the decades around 3700 cal BC, taken from the models defined in Figs 12.5, 12.22, 14.1, 14.7, 14.92, 14.101, 14.104, 14.119, 14.134 and 14.173 (with their component parts where appropriate).

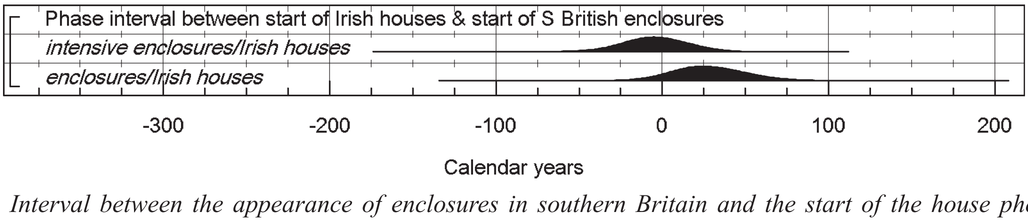


Fig. 14.183. Interval between the appearance of enclosures in southern Britain and the start of the house phenomenon in Ireland, derived from distributions shown in Figs 12.22, 14.1 and 14.7.

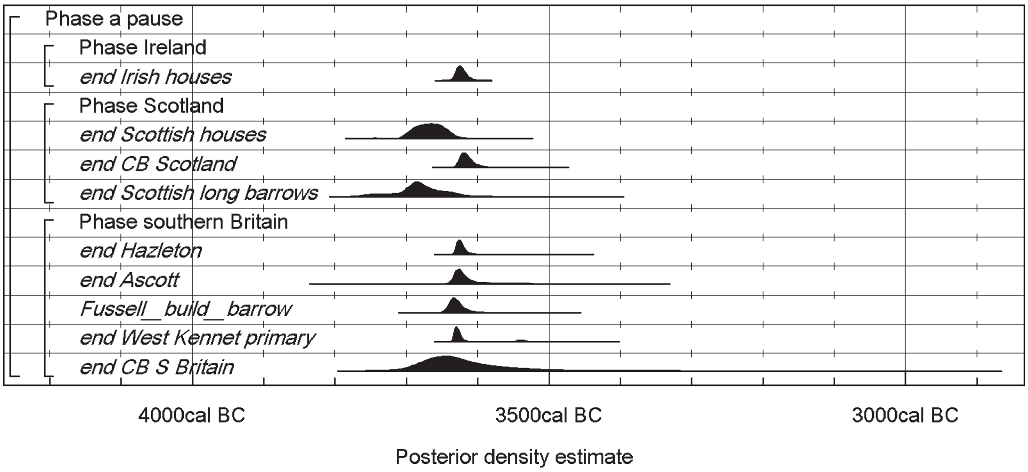
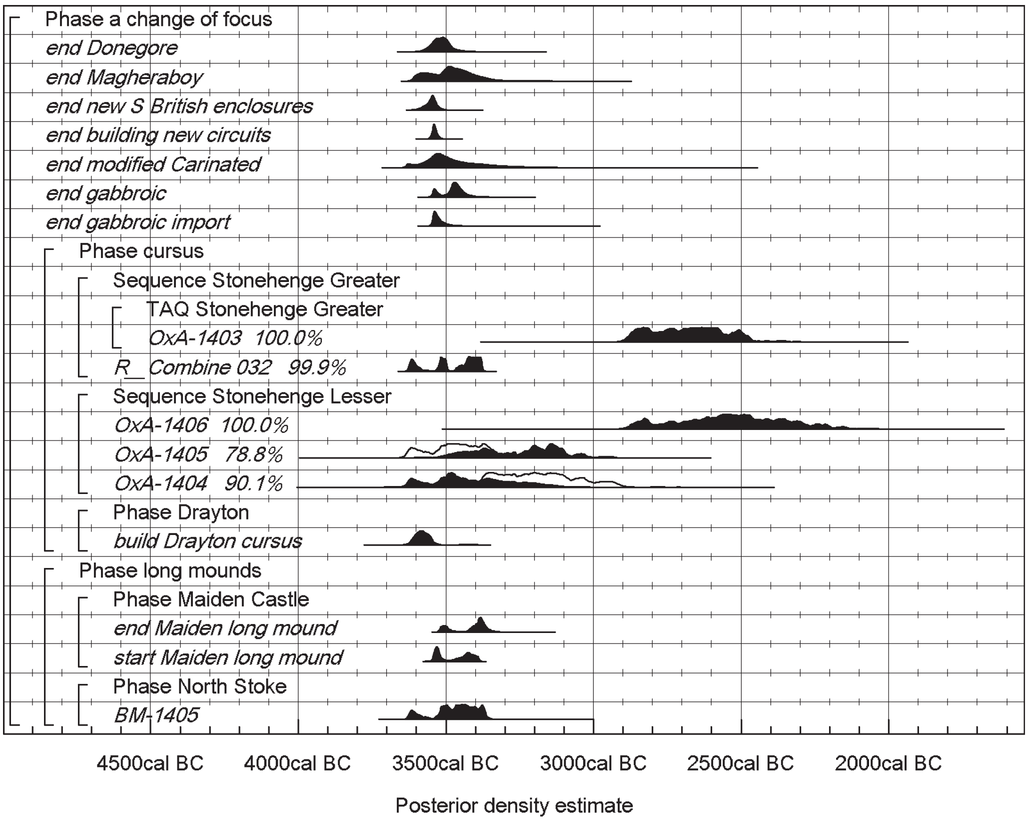


Fig. 14.184. Probability distributions showing the date when old practices ended during the 37th century cal BC, derived from models defined in Figs 12.22, 14.88, 14.158, 14.167, and 14.173 (and their component parts if appropriate), and by Bayliss et al. *(2007b, fig. 6) (West Kennet), Wysocki* et al. *(2007, fig. 10) (Fussell's Lodge), Meadows* et al. *(2007, figs 6–9) (Hazleton) and Bayliss* et al. *(2007c, figs 3 and 5–7) (Ascott-under-Wychwood).*



14.185. Probability distributions showing the change of focus in Neolithic activity in Britain and Ireland during the 36th century cal BC, derived from models defined in Figs 12.5, 12.15, 14.7, 14.4 4, 14.104, 14.118, 14.134, 14.137 and 14.164 (and their component parts if appropriate).

3600 cal BC, although modified Carinated Bowl may have been used rather longer (Fig. 14.165). Carinated Bowl in southern Britain also went out of use in the 37th century (Fig. 14.184). In the first half of that century, it seems that the construction and use of long barrows and related forms in Scotland ceased, giving this monument type a limited period of popularity there. Around the same time, the last of the Scottish timber halls was demolished (Fig. 14.184), giving this type of structure an even shorter currency.

The later decades of the 37th century also saw the closure of a number of the small sample of southern British long barrows which have currently been dated precisely

(Fig. 14.184). There is a contrast here. In Scotland long barrows were replaced by monuments of other types – chambered cairns and linear constructions among them. In southern Britain, despite these endings of particular monuments, the long barrow tradition continued to the end of the millennium (Fig. 14.46). In Ireland too, these decades at the end of the 37th century cal BC saw changes in practice. The rectangular house phenomenon dwindled as quickly as it had arisen and did not revive in the same form. The coincidence of these changes with the maximum input of resources into enclosure building in southern Britain (Fig. 14.20) may point to the displacement of old practices by a now fully developed system of large-scale aggregation and long-distance networks.

The peak of enclosure construction at the end of the 37th century was short-lived, and was succeeded by a lull in construction, at least in central southern England (Fig. 14.22). Unlike the Irish houses or the Scottish long barrows, however, the fortunes of enclosures revived and construction was again popular in the second half of the 36th century cal BC, although no new enclosures were founded after the middle of the century (Fig. 14.12: *end new S British enclosures*) and by 3500 cal BC over 80% of the construction effort had been expended. The ending of this second hey-day coincides with the abandonment of Donegore and Magheraboy in Ireland, perhaps the end of the currency of modified Carinated Bowl in Scotland, the demise of the long-distance transport of gabbroic pottery, and a decline in the long-distance transport of stone axeheads. Is this really the end of the world of the enclosures? Decorated Bowl continued to be used and the primary use of a very few enclosures persisted for another century or two (Etton, Windmill Hill, Hambledon Hill). But this continued use is the exception, not the rule. It is at this time that cursus monuments and bank barrows begin to be built. Although cursus monuments are later than enclosures in the few cases where there is a stratigraphic relationship between the two, a period of overlap during the 36th century cal BC, when both types of monument were being constructed, is suggested by the comparatively early date of the Drayton cursus (Fig. 14.185).

Otherwise, it is difficult to continue the narrative. The world of the second half of the fourth millennium – not the focus of this project – is still shrouded in uncertainty. We have not attempted to assemble the existing data or to model the chronology of things and practices which appear in this period, so that our endings stand alone without a comparable framework for successive developments.

14.9 Conclusion

In this chapter, we have attempted to tease out threads of chronology from the varied body of evidence for the early Neolithic in Britain and Ireland. This is the first attempt anywhere to use Bayesian statistical modelling of radiocarbon dates to produce a quantified, chronological narrative on such a scale. We have focused on causewayed and related enclosures, but have assembled the dating evidence for the preceding centuries of the Neolithic and proposed a detailed chronological framework. This structures the social context in which the enclosures emerge as a developed aspect of the insular Neolithic. Our dating of the enclosures themselves has revealed the tempo of the phenomenon – the pace of its introduction, the cycles of its popularity and the rhythms of its demise. Our chronologies for the time when enclosures came to an end are much fuzzier. We have not been able to invest the same effort to construct such detailed, quantified chronologies beyond 3500 cal BC, and so our understanding of the circumstances in which enclosures fell out of favour remains, comparatively, limited.

George Box (1979, 202) reminds us that 'all models are wrong, some models are useful'. The models presented in this chapter, and the data upon which they are based, are not of even quality. For enclosures, we have obtained a large series of new radiocarbon dates, chosen short-life samples and rigorously assessed the association between each sample and the context from which it was recovered. As importantly, wherever possible the samples have been selected around the chronological model (Bayliss and Bronk Ramsey 2004, 26), exploiting site stratigraphy to provide 'informative prior information' and refine the resultant date estimates. This approach has proven highly effective, both for recent excavations and, perhaps surprisingly, for sites where fieldwork took place as far back as the 1920s.

In our models we have routinely implemented a uniformly distributed phase of activity to counteract the statistical scatter on suites of radiocarbon dates. Although this 'uniformative prior information' component of our models is generally robust (Buck *et al.* 1992; Bayliss *et al.* 2007a, 14–17), it may not be appropriate if the archaeological activity in question is distributed very differently. For example, we have seen that more than 80% of the effort expended on enclosure construction was made between 3700 and 3500 cal BC, and less than 20% in the succeeding 200 years. The period of the construction of the circuits of causewayed enclosures is thus not uniformly distributed, but dramatically skewed towards the early centuries, with a much lower level of activity later (see above). In such circumstances, we may be able to use statistics such as the index of agreement to guide us in the selection of our models (see Chapter 2.4.4), and we must be very clear as to exactly what our models mean in archaeological terms. We have frequently employed sensitivity analyses (alternative models), to address issues such as these. 'All models are wrong' but, when several independent models give very similar results, it is implausible that they are *importantly* wrong (see, for example Fig. 14.109 which shows three independent models for the currency of Decorated Bowl in different areas of southern Britain which produce almost identical date estimates).

This project was designed to investigate enclosures. Our comparative models are reliant on the existing corpus of radiocarbon dates, which is of variable quality.

Our understanding of the chronology of enclosures is consequently much more robust than our models for the dating of other Neolithic things and practices. There is a large sample of well dated enclosures, and a high proportion of all known enclosures have been dated (Fig. 1.1). Our estimates for the currency of the phenomenon are therefore based on the sound foundation of explicitly quantified estimates for the dates when individual sites were used. In contrast, our models for the chronology of other elements of the Neolithic are a rag-bag mix of the good, the bad, and the downright hideous! There are large series of high-quality radiocarbon dates available, for example for short-life samples closely associated with Carinated Bowl in Scotland. The dating of some sites, such as the early Neolithic houses at Warren Field, Crathes, and Claish, is exemplary. For some problems, the collection of relatively small series of samples on a repeated basis has proved invaluable, such as for early Neolithic occupations from the south-west peninsula of England. In other instances, our models are highly provisional, because the available dates are few, or of low quality. For example, only a single radiocarbon date, of the 29 so far available from the many linear monuments in Scotland (Fig. 14.170), is from short-life material.

From this, it is clear that there can be nothing definitive about the chronologies presented here. They are our preferred interpretations, given the radiocarbon dates, contextual information, and statistical models available to us during this project. All will develop over the coming decades, and it is clear that there is much work to be done before our chronologies are as refined and robust as current methodologies now allow. So, we make no pretence that all our models are entirely right. Some of them will be *importantly* wrong (models 2 and 3 for the early Neolithic in Ireland are mutually contradictory and so cannot both be right!). Nonetheless, we feel that the scale of difference between the refined, quantitative chronologies which we have presented here and the impressionistic and fuzzy nature of previous frameworks cannot be exaggerated. Our new, more precise chronologies provide a structure which will enable prehistorians to trace sequences, where previously the unfoldings of past lives were compressed into one, to compare contemporary events and phenomena to reveal the diversity of choices made by past people, where in earlier research we have been unable to distinguish their voices, and to begin to unpick the varying tempos and scales of past change, where previously we were forced to dwell largely in the long-term. Chapter 15 will go on to explore why such differences matter.

Notes

1 Developments are underway which will enable alternative approaches to be adopted for the modelling of this data set, in particular the implementation of the trapezium distribution (Karlsberg 2006; Bronk Ramsey 2009a). These were not available at the time of writing.

2 In the case of one segment of the outer ditch at Windmill Hill, it is now clear that Ebbsfleet pottery quite low in the filling is due to a recut of considerable size (Chapter 3).

3 These are: Crickley Hill, Etton, Hambledon Hill main enclosure, the Stepleton enclosure, Whitehawk, Windmill Hill, Abingdon, Whitesheet, Maiden Castle and St Osyth.

4 These are: Crickley Hill, Hambledon Hill main enclosure, the Stepleton enclosure, Whitehawk, Windmill Hill, Abingdon, Whitesheet, Maiden Castle, St Osyth, Hembury and Chalk Hill.

5 Since this chapter was written, a handful of new dates on cremated bone from portal tombs/dolmens (note that we use these terms interchangeably) have been published (Kytmannow 2008, table 7.1). None of these suggest any earlier dating.

6 We have excluded the superficially early dates from the Raunds long mound (Chapter 6. 3) and the Eynesbury cursus monuments (Chapter 6.2) from the models for the reasons detailed in Chapter 6.

7 See Chapter 10, endnote 1, for details of Sperris and Zennor Quoits, for which dates have since been obtained.

8 In a PhD at Cardiff University, supervised by Alasdair Whittle and Alex Bayliss, and funded by the AHRC Collaborative Doctoral Awards scheme and English Heritage.

9 The final publication became available after our modelling.

10 The earlier tails on the estimates for *start NE Carinated* and *start modified Carinated* almost certainly arise from there being insufficient data in these models to fully account for the statistical scatter on the radiocarbon dates; see Chapter 2.2.

11 Oliver Harris and Ian Ralston, pers. comm.

12 Only the long tails of date estimates provided by models containing insufficient radiocarbon dates to effectively counteract their statistical scatter (see again Chapter 2.2) appear earlier than this; and even these distributions (e.g. *start Scottish monuments*; *start NE Carinated*; Fig. 14.175) are more likely to fall in the second half of the 38th century cal BC or later.

13 In contrast to the regional variation in date estimates for the start of the Neolithic in Southern Britain (Fig. 14.54), perhaps suggesting the potential for multi-focal beginnings there, no such variation is apparent in the wider analysis of Britain and Ireland (Fig. 14.176). The first Neolithic things and practices appear across wide areas in the decades around 3800 cal BC: only in Ireland (if model 2 is preferred) and South Wales and the Marches (Fig. 14.54) may they appear rather later.

14 See Chapter 11, endnote 4; the dates for this house are now available.

15 Gathering time: the social dynamics of change

Alasdair Whittle, Alex Bayliss and Frances Healy

> The concept of pre-history is one of the most ridiculous that can be imagined
>
> Lucien Febvre, *A new kind of history*, 1973, 35

15.1 Temporality and the dynamics of social change

On the basis of the explicit, quantified, probabilistic chronological models offered so far, we go on now to interpret what we have learned not only of the timing but also of the tempo and character of change, and thereby to explore the social dynamics of change.

More reliable timing allows us to sequence sites and events accurately. From a more confident sense of order, we can establish more reliably the connections, equivalences and contrasts, and better discriminate among the array of innovation, tradition, choice and agency. Timing enables tempo, a sense of the rate at which changes come, beyond the retentions and flow of time to which Tim Ingold (1993) refers. Timing and tempo together open up the possibility of seeking the underlying social dynamics of a shifting world. This chapter will develop interpretations to try to account for the timings, accelerating tempo and altering dynamics of this social world, and this will bring us to discussion of connections and networks, emulation and competition. It will attempt to give a connected and sequential commentary on the first centuries of the Neolithic in southern Britain and Ireland, going on from the narratives presented in Chapter 14, which will unite the debates about beginnings with what came after, and the discussion of individual features with a longer history. Both ends of this interpretive process unavoidably will be incomplete, since we have comparatively slight, and largely undated, evidence for late Mesolithic activity over most of these islands, on the one hand, and the middle part of the Neolithic has been beyond the remit of this project, on the other. But although the framework we have created here will be modified over the coming years, it allows us now to question many of our current understandings, and to offer new interpretations of the development of the first centuries of the Neolithic in southern Britain and Ireland, and further afield.

There is one important caveat. As Chapter 14 should have made clear, our own timetables are most reliable for causewayed enclosures in southern Britain; we have dated nearly 40 of these, many (though not all) with considerable precision. Our schedules for the development of other kinds of early Neolithic activity, including the beginnings of the period, are necessarily both less precise and at this stage less reliable. So the commentary that follows perforce is based on chronologies of varying precision. This produces a tension between the core of our own study, the wider British and Irish timescapes which we have sought to model, and the generally more informally modelled continental contexts which we also seek to pull in.

Beyond the details of this particular project lie wider issues about timescales and the dynamics of agency, social reproduction and change. We will conclude by reflecting on issues raised right from the start of the volume. If we can now offer greatly improved chronological resolution, we can begin to break down any sense that it is inevitably and unavoidably only the long-term which is open to investigation in these millennia, and start to break away from fuzzy prehistory. We will consider not only different kinds of timescale but also different kinds of agency, memory and cultural transmission that may have helped to condition the structures within which history unfolded. These come in the first place out of this particular study, but are shaped by reference to a much wider comparative literature, and they may serve also to illustrate what could now be possible in other studies.

15.2 Beginnings

Past positions and present possibilities

Few subjects have been as challenging as the question of the Mesolithic-Neolithic transition in Britain and Ireland. As noted in Chapter 1, opinion has tended to polarise around the opposed alternatives of colonisation and acculturation (e.g. Sheridan 2003a; 2003b; 2004; 2006a; 2007a; 2010; Pailler

and Sheridan 2009; versus J. Thomas 2003; 2004a; 2004b; 2007a; 2008), and to some extent different processes have been sought in Britain and Ireland, acculturation having been the more favoured interpretation in Britain – for a while at least – and colonisation in Ireland (Cooney 2000a; 2003; 2007a). The style and character of the arguments of the leading British protagonists have been rather different. Alison Sheridan has proposed a succession of contacts and arrivals, with specified chronologies derived from visual inspection of radiocarbon dates from Britain and Ireland on the one hand, and from similarly constructed sequences for supposed continental source areas, backed up by ceramic and monumental typologies, on the other. Julian Thomas, in allowing for difference of process between Britain and Ireland (2008, 70), has nonetheless emphasised a very swift shift to domesticated plants and animals, pottery, timber architecture and polished stone tools *c*. 4000 cal BC, again based on visual inspection of radiocarbon dates, rapid initial change contrasting with 'the development of a fully agricultural landscape' over 'many generations' (2008, 80). Sheridan has proposed specific conditions in supposed continental source areas which prompted the movement of people (internal social disruptions in Brittany and Normandy; culture change and settlement expansion in northern France and Belgium), set against a claimed general lack of contact between offshore Mesolithic communities and the continent. Thomas, by contrast, has referred to material selections and recombinations, and to an array of subsistence, ideational and settlement factors, but without specifying particular reasons or motivations for the supposed timing of what he sees as rapid events *c*. 4000 cal BC. Sheridan presents a nuanced but short history, which gets the new folks ashore, as it were, then leaves them to their own devices, whereas Thomas offers a more general narrative, but for a longer story over several centuries.[1]

Other suggestions of a combination of processes have on the whole been less frequent (e.g. Whittle 2007a), but one variant, in terms of dominant and more active but numerically inferior colonists, can be noted. One of the most recent statements by Sheridan proposes 'small communities coming from the continent', and 'allows for the subsequent – and apparently rapid – acculturation of indigenous communities' (Pailler and Sheridan 2009, 1–2). There has been a strand of regional differentiation (back to at least Armit and Finlayson 1992; and see Piggott 1955) but proposals of the kind that there could have been more acculturation in the west and more colonisation in the east of Britain (Cummings and Whittle 2004, 88–91) have not been common. Debate remains very active; a recent example is a set of landscape perspectives (Finlayson and Warren 2010). How does all this look in the light of our models?

It is convenient to frame our own view in the first place with respect to the narrative interpretations of Sheridan, since she has made the most sustained efforts to define the chronological detail of the transition (summarised in Chapter 1.5). We have no serious disagreement with the episode of contact that appears to be represented by the Ferriter's Cove evidence. This leaves open the possibility, from at least as far back as the middle of the fifth millennium cal BC, of movement by boat up and down the western side of Britain and Ireland. (This need be no surprise in its own right, given the plentiful evidence from the north-west seaboard of Scotland for the movement of raw materials in the Mesolithic: Saville 2004b). At this date, the obvious source area for cattle and sheep is north-west France. The Ferriter's Cove situation is surely also significant with respect to the arguments about isolation. There is no evidence to suggest whether contact was established with the outside world from south-west Ireland, or the other way round. If the former, the general argument of Sheridan in support of colonisation as the contextually most likely process is weakened. We have no way of telling if other situations of this kind remain to be discovered (other domesticated fauna so far dated in Ireland probably relate to the later, more established beginning of the Neolithic in Ireland; Fig 12.42). Other contact finds can be cited from other situations in continental Europe, such as the Balkan clay seal found recently in a late Mesolithic context in northern Switzerland (Mauvilly *et al.* 2008), or Danubian imports into the Ertebølle world (Fischer 2002; Klassen 2004; Larsson 2007); the pair of domesticated cattle in a pit under Er Grah in the Morbihan, Brittany (Fig. 15.1), may also be another instance of initial contact (Tresset 2005a, 274–5; Tresset and Vigne 2006). In the light of these other cases, it seems an open question whether late Mesolithic communities in Britain were isolated or not. And the fact of contact does not appear to determine the shape of subsequent events and processes.

If we allow pre-Neolithic movement of domesticates, should we not also include in our models pre-Neolithic occurrences of cereal-type pollen? In Britain, these are often dated, as at Ballachrink, Isle of Man, to the earlier part of the fifth millennium cal BC, in contexts where there are other indicators of woodland disturbance (Chapter 11; Innes *et al*. 2003; Davey and Innes 2003); they have also been part of the discussion about LBK and even pre-LBK horticulture in the Alpine area and central Europe (Haas 1996; Lüning 2000). In the insular context, could these not be another 'bow-wave', an early form of experimentation with cereals and forest farming by, say, indigenous populations? We repeat the concerns raised in Chapter 14 (based on issues of identification, taphonomy and stratigraphy, and lack of corresponding archaeological evidence) and note the apparent absence of such occurrences closer to what we have identified as the start of the established Neolithic – thus in the second half of the fifth millennium cal BC – just at the point when one might suppose that a practice, allegedly widely established given the geographical range of its occurrences (Innes *et al.* 2003, fig. 1), would be further intensifying. Neither Sheridan nor Thomas has brought this phenomenon much into their accounts so far. Gabriel Cooney, who has confronted it (2007a, 548), is cautious, but open-minded. This problem remains open.

Our greatest disagreement with Sheridan rests in the

Fig. 15.1. The cattle pair in context e4 beside the Er Grah monument, Locmariaquer, Brittany. Left: view; right: detail. Photos: Jean-Denis Vigne.

matter of her claimed late fifth millennium cal BC movement from Brittany, bringing new people up the western coast of Britain as far north as Argyll in western Scotland, where they are represented in a tomb at Achnacreebeag. The interpretation can be challenged on several fronts.

In Brittany, recent work brings into doubt the proposed fifth millennium cal BC date of any such Breton strand. Sheridan (2010) suggests a currency of 4300/4200–4000 cal BC for late Castellic pottery in the Morbihan, which she considers related to the vessels from Achnacreebeag. But formal, Bayesian modelling of the relevant dates suggests that Castellic pottery did not go out of use there until *4120–3610 cal BC* (*95% probability*; *End*; Cassen *et al*. 2009, fig. 13, table 10), or until *4030–3770 cal BC* (*75% probability*).[2] Even if the Achnacreebeag pots do derive from the Castellic tradition, therefore, there is no necessary contradiction with the date estimate for the start of Neolithic things and practices in southern Scotland presented in Chapter 14.7 (*3835–3760 cal BC* (*95% probability*; Fig. 14.150: *start S Scotland*), probably *3815–3780 cal BC* (*68% probability*)). The supposed circumstances of internal social disruption in Brittany itself, claimed to have led to refugee boat people heading far north to escape them, can also be questioned, given how difficult it has been to establish reliable timings for the monuments of Brittany (Müller 1998; Cassen *et al*. 2009). Some pre-existing single menhirs were broken up and reset into substantial passage tombs such as La Table des Marchands and Gavrinis (Le Roux 1984; Cassen 2000; 2009), and the stone row adjacent to La Table des Marchands was dismantled (Fig. 15.2). But the dates of these events are not yet precisely established, and they could have many different explanations. These could include enhancement of new constructions by the incorporation of the old, which may or may not have been accompanied by social upheaval.

There are also doubts at the Argyll end of things. The Achnacreebeag monument lies in a today quite remote location on the north side of Loch Etive, on a narrow coastal strip backed by high hills (Fig. 15.3). It can be fitted without difficulty into local developments. The monument did not attract exceptional attention from Audrey Henshall, who assigned it to her Hebridean group (1972, 357–8), nor from its excavator Graeme Ritchie, who followed similar connections (1970; 1997, 74–6). Both its phases appear rather simple, a possibly closed cist in the centre of the cairn followed by the chamber inserted into the edge of the cairn and approached by a very short passage. This does not appear to constitute a highly distinctive monument

Fig. 15.2. View of La Table des Marchands and Le Grand Menhir Brisé, Locmariaquer, Brittany, under excavation. Photo: Serge Cassen.

(*pace* Sheridan 2010). The decorated Bowl pottery came from the second phase. Originally this was compared to the Beacharra style of decorated western Scottish Bowl pottery (Ritchie 1970; 1997; Sheridan 1995, 11, fig. 2.3), and wider reference too might be made to decorated Bowl traditions of the mid-fourth millennium cal BC in Ireland (Case 1961; Sheridan 1995). The decorative motif of inverted arcs is widespread. Although it does occur on Castellic pottery, it is also found in the repertoire of Irish passage tomb 'art' (most recently treated by Robin 2009). The bowl forms of the Achnacreebeag and various French pots are not identical, though admittedly similar. Neither phase of the Achnacreebeag monument has been radiocarbon dated (though Ritchie recorded charcoal from under the cairn (1970, 34), and this could and should be radiocarbon dated, if it survives).

Beyond these specific worries, we are struck by the lack of other evidence of this kind. Even if this was a small-scale arrival, we might reasonably expect some other signs of it up the west coast of Britain and around Ireland. In the early scenario, there should be a scatter of radiocarbon dates, falling into the centuries around 4000 cal BC, associated with Neolithic material of this kind from other sites, along the proposed migration route. Our detailed reviews of dates associated with early Neolithic things and practices in the south-west peninsula of Britain (Fig. 10.30), in south Wales and the Marches (Figs 11.10–11), and in Ireland (cf. Figs 12.54 and 12.56) have revealed no such evidence. More limited exercises reviewing comparable bodies of data from the Isle of Man (Fig. 14.148) and southern Scotland (Figs 14.150–3), similarly have revealed no evidence for Neolithic activity before the later 39th century cal BC. Recent, thorough, reviews of the evidence in north Wales

Fig. 15.3. View of the Achnacreebeag cairn, Loch Etive, Argyll and Bute, Scotland, under excavation. Photo: © RCAHMS.

and north-west England present similar patterns (Griffiths forthcoming). And, anyway, why should supposed Breton refugees have had to flee so far – all the way to remote Loch Etive, as far as we can discern ignoring Cornwall, south Wales, Ireland, south-west Scotland, and other points between?

If Achnacreebeag indeed had Breton connections, it could have resulted from a single, isolated contact without wider repercussions, and, on the evidence of the Breton chronology, could have occurred in the early fourth millennium cal BC rather than the late fifth.

The only other location specifically cited by Sheridan (2010) is the monument at Carreg Samson in south-west Wales (F. Lynch 1975). There are two issues here. Sheridan has classed this as a simple passage tomb, whereas we would rather see this as within the repertoire of portal tombs (though Frances Lynch (1976, 31) also sets it apart from them). She has claimed its one pot, a plain bowl of very simple form, as similar to Breton middle Neolithic forms, but it appears to us to fit well enough within insular Bowl styles. While portal tombs have often been claimed as an early form of monument (including by Cummings and Whittle 2004), on the basis partly of their simple architecture and partly of associated Bowl pottery (F. Lynch 1972; 1976), the three in western Britain which currently have radiocarbon dates (Carreg Coetan, Pembrokeshire, and now Zennor and Sperris Quoits, Cornwall) all fall in the mid- or late fourth millennium cal BC (Chapter 10, footnote 1; Chapter 11.4). The monument at Broadsands in Devon is also classified by Sheridan as a simple passage tomb, and is estimated to have been constructed in *3870−3710 cal BC* (*95% probability*; Fig. 10.30: *start broadsands*), probably in *3815−3740 cal BC* (*68% probability*). We do not see its simple form as easily categorisable, especially given its damaged state at the time of excavation, and the associated pottery is Carinated Bowl, and therefore from a very different tradition to that of Brittany. The monument belongs rather, in our view, to a diversity of early constructions found across southern Britain (and discussed further below). Because of our reading of sample associations, we have not accepted the claims for an early date (in the early fourth millennium cal BC) for the Carrowmore passage tombs in Co. Sligo (see again Chapters 12 and 14).

Generally, therefore, we can see no convincing evidence for a widespread migration from Brittany up the western coast of Britain in the early Neolithic, and certainly no evidence for any such movement in the last centuries of the fifth millennium BC.

In contrast, we are in broad, but not complete, agreement with the latest formulation by Sheridan (2010) of both the character and start date of the 'Carinated Bowl Neolithic' found widely across southern, eastern and northern Britain, and Ireland, but disagree in important details. Her description of novel pottery, lithics and lithic production sites including deep flint mines, timber structures, domesticates and various non-megalithic funerary structures accords in general with what we have also set out in the regional chapters and again in Chapter 14. Even if there are selection and recombination from continental sources, or what Thomas has previously called *bricolage* (J. Thomas 2003; 2008, 77), and while not every element of these innovations occurs together at every site, the extent of change is very striking.

One major question is the problematic nature of the date of the Magheraboy enclosure in Co. Sligo, which, on present evidence, may have been built in the 40th or 39th century cal BC (Fig. 12.15: *start Magheraboy*). Given that the Carinated Bowl Neolithic has also been labelled 'trans-Manche est', and that its affiliations (by whatever process) appear to lie broadly in an area between the Paris Basin and the Low Countries (Sheridan 2007a; 2010) and that the form of the enclosure itself at this date is echoed in the Paris Basin and eastwards (see below), it remains very surprising that the only potential early example of enclosure construction should occur so far west; we should keep in mind that up till now no causewayed enclosure has been discovered in Brittany or Normandy. Magheraboy keeps open, in a different way to mooted Breton and Norman connections, the possibility of small-scale arrivals on the west side of Ireland. If it really dates to the earliest fourth millennium cal BC, it may have been an event or experiment that did not have immediate major consequences, given the chronological gap till the better documented beginnings for the Neolithic in Ireland *c*. 3800 cal BC. We will come back to the site, and the possibility (discussed further in Chapter 14) that it could date somewhat later, in our discussion of beginnings in Ireland and western Scotland.

Our main divergence from Sheridan's scenario rests in the details of the dating of this phenomenon. In a previous account she saw its beginning in the 40th century cal BC, and strongly implied a more or less simultaneous spread, at least across England and Scotland (Sheridan 2007a). Her most recent interpretation is more cautious (Sheridan 2010). She refers to beginnings, still principally using visual inspection of radiocarbon dates, at *c*. 4000 cal BC, citing both Yabsley Street, Blackwall, and Coldrum, Kent (the single rim fragment from which is of unknown style). She characterises the phenomenon as a whole as 'arriving over much of Britain and most of Ireland within the first two centuries of the fourth millennium', going on to claim that 'the appearance was diaspora-like across wide areas of Britain and Ireland, rather than consisting of a primary point of colonisation in the south-east, followed by spread from that point' (Sheridan 2010).

Her more cautious view that the appearance of the Carinated Bowl Neolithic took two centuries can broadly apply to southern England, as we have shown in Chapter 14 (Figs 14.54 and 14.58), though the Carinated Bowl presence in south-west England is slight. But the latest account of Sheridan does not accord with the stadial spread across southern Britain proposed in Chapter 14, nor with the start dates of *c*. 3800 cal BC which we have proposed for Ireland, the Isle of Man and southern and north-eastern Scotland (Fig. 14.176). We have argued for a different kind of diaspora, perhaps spreading from an initial area

of innovation in the south-east of England (although the current data could mask a more complex web of beginnings within southern England (compare Figs 14.54 and 14.58), and changing and accelerating in tempo as it extended to much of Britain and Ireland (Fig. 14.177). Our model also diverges from the generalising view of Thomas (2008) of very rapid initial change, which is implied to have taken place everywhere more or less simultaneously. This divergence serves not only to provide a very different chronology for the beginning of the Neolithic across Britain and Ireland, but also further to differentiate among the elements of innovation listed by Sheridan (2010). Timber houses and halls, for example, cannot now in our view simply be listed as an automatic or inevitable part of a package of novelties, since in both eastern Scotland and Ireland we can propose a very distinctive horizon for their occurrence, and this too has to be taken into account when interpreting the process of change at the beginning of the Neolithic in different parts of the offshore islands.

We agree in part with the characterisation of the proposed 'trans-Manche ouest' strand or strands of Sheridan (2007a; 2010). Carinated Bowl pottery is rare in the south-west and the South-Western style is dominant. Such difference requires explanation. We are less sure that it need be related specifically to sources in Normandy. Specific Norman origins for Broadsands are not proven. As for her third element of this 'trans-Manche ouest' strand, rotundae, a much later dating has been proposed in Chapter 9 (and see again Chapter 14). Sheridan (2010) has proposed arrival 'some time between 4000 and 3800' cal BC and 'during the first quarter of the fourth millennium'. The latter characterisation accords better with the models set out in Chapters 10 and 14, which suggest that the earliest Neolithic activity in the south-west peninsula probably began in the later 39th or earlier 38th century cal BC (Fig. 10.30: *start Neolithic settlement*).

A provisional scenario for initial colonisation

Taking both the factors discussed above and our proposed chronological framework into account, we can now offer our own story. The narrative of the Mesolithic-Neolithic transition need not be reduced to a single one. Though we are hampered by the continuing lack of good evidence for late Mesolithic activity in south-east England, which emerges as a major research priority for the future, and so far, individual sites such as Yabsley Street, Coldrum and White Horse Stone have provided positive evidence of only part of the range of innovations at the start of the Neolithic, we believe that the current evidence for earliest beginnings in the south-east of England, closest to the continent, coupled with the extent of innovations stressed above, probably does speak for some kind of initial colonisation. Dramatic new practice extends to the digging of deep flint mines in Sussex, most plausibly following established traditions of deep extraction, which go back in central Europe to the LBK in the sixth millennium cal BC (e.g. Eisele *et al.* 2003), and which were part of the activities of the Michelsberg culture in southern Belgium (see also Chapter 5.9).

The continental foreground: a brief survey

But why the 41st century cal BC, and why south-east England? A long time ago, one of us argued for a background of settlement expansion on the adjacent continent as the context from which newcomers from expanding populations budded off to colonise southern Britain as a whole (Whittle 1977b; cf. Case 1969). The original formulation got the chronology wrong, as it argued for change beginning in the earlier to mid-fifth millennium cal BC, in the post-LBK horizon. A later version, as chronology began to be revised (e.g. Kinnes and Thorpe 1986), suggested that an earlier date for the start of the British Neolithic would favour colonisation, but a later date acculturation (Whittle 1990a). That too looks doubtful. The spirit of explanation, however, in terms of change among Neolithic communities on the adjacent continent must still apply, even if a more subtle interpretation is now required. Sheridan has consistently made reference to this continental setting, especially to changes in Brittany, Normandy and a restricted area of northernmost France, as we have already seen, as well as to the movement of Alpine jadeitite axes (e.g. Sheridan 2010, and earlier references), but it is worth taking a broader if brief look at things, in order to evaluate as critically as possible the context from which colonisation of some kind into south-east England may have arisen.

The LBK and post-LBK longhouse world probably came to an end at some point in the middle of the fifth millennium cal BC. While the combination of typological series, stratigraphy, spatial developments and visual inspection of radiocarbon dates has suggested a precise chronology for the development of the LBK in the sixth millennium (Stehli 1994; Stäuble 2005; see also the dendrochronological evidence of wells: e.g. Koschik 2004), the chronology of fifth-millennium central Europe is still a matter of discussion because of conflicts between scientific dating and contextual analyses (Spatz 1999; Müller 2004; see also Dubouloz 2003 for the Paris basin). It is not possible to be precise about the continental chronology of much of the fifth millennium, since with the exception of the extensive dendrochronologies of the Alpine foreland beginning with the start of Neolithic settlement there *c.* 4300 BC (Schlichtherle 1997; Menotti 2004), sequences are very weak.

In spite of such difficulties, the mid-fifth millennium is a convenient starting point. Looking back, the LBK had appeared on parts of the Rhine perhaps between *c.* 5500 and 5300 cal BC (Gronenborn 1999; 2007a; Lüning 2000; Stäuble 2005), and was west of the Rhine, on the Aldenhovener Platte, in Dutch Limburg and parts of eastern southern Belgium perhaps from *c.* 5300 cal BC onwards (Louwe Kooijmans 2007; Crombé and Vanmontfort 2007); LBK or Rubané récent settlement perhaps appeared in the Paris basin of northern France in the very late sixth millennium cal BC (Allard 2007; Demoule 2007a).

The LBK, once seen as the classic colonisation fuelled by demographic growth, is now harder to characterise. There may have been both newcomers and local people involved from its inception (Gronenborn 1999; 2007a; Kind 1998; Lukes and Zvelebil 2008; Tillmann 1993), and isotopic analysis in particular has suggested what Detlef Gronenborn has called 'multi-tradition communities' (2007a, 84; see also Lukes and Zvelebil 2008). But in any one region opinion may remain divided. West of the Rhine, for example, Leendert Louwe Kooijmans is in no doubt of the reality of the intrusion of a fully formed way of life into the Graetheide (2007, 295; cf. Amkreutz *et al.* 2009), though some researchers only a little to the south in Belgian Hesbaye allow more complex interactions (Lodewijckx and Bakels 2009).

Perhaps within the blanket, so to speak, of shared culture in the LBK (cf. Robb and Miracle 2007), there were such divergences from region to region. There were certainly differences at a wider scale. The northern limits of the LBK and post-LBK world on the fringes of the north European plain did not alter much until the late fifth millennium cal BC; there was certainly contact with the Ertebølle world of the Baltic coast and southern Scandinavia, but without, so it would appear, Ertebølle identity being altered until the probably indigenous adoption of Neolithic things and practices perhaps just before or around 4000 cal BC (Fischer 2002; Klassen 2004; Hartz *et al.* 2007; Larsson 2007; Müller 2010a). The main changes observable within southern Scandinavian and northern German societies took place through the early phases of the TRB, with most of them estimated to have come later than *c.* 3800 cal BC (Müller 2009). Nor does LBK and post-LBK settlement appear to have spread beyond its initial extent in the southern Netherlands and Belgium, but on the evidence recovered by a series of deep excavations, especially in the Rhine-Meuse estuaries (Fig. 15.4), local communities only some 80–100 km distant maintained their own identity while gradually adopting elements of Neolithic things and practices through the fifth millennium cal BC: first pots, then pigs and cattle, and finally cereals (Louwe Kooijmans 2001a; 2001b; 2007). More established Neolithic practice and settlement are seen at a date estimated at *c.* 3600 cal BC at sites like Schipluiden in coastal Delfland (Louwe Kooijmans and Jongste 2006; Louwe Kooijmans 2009; see also Verhart 2000a). This important archaeological sequence is punctuated, rather than continuous, but it constitutes a process of indigenous change very close to south-east England.

In the Paris basin, opinion is divided on the process which brought the Rubané récent into existence (see Allard 2007). There was then a process of extension in the first half of the fifth millennium cal BC, principally to the west – and we still appear to have a rather hazy notion of the precise distribution of Cerny settlement, the cultural group at the end of this sequence in the middle part of the millennium, in relation to the Channel (Constantin *et al.* 1997; Demoule 2007b, 93). Extension to the west brought interaction with indigenous communities in north-west France, especially Brittany, themselves probably also in contact with or aware of Neolithic things, practices and ideas to the south, ultimately in the west Mediterranean (Marchand 2007; Scarre 2007a). Out of this contact appears to have emerged the first Breton Neolithic in the middle of the fifth millennium cal BC (Cassen *et al*. 2000; Cassen *et al.* 2009, fig. 13; Marchand 2007; Scarre 2007a).

These diverse transitions were variously accompanied by profound culture change, so there were complex processes at work. This is further complicated by the fact that the new cultural identities of the post-longhouse world – principally the northern Chasséen, Michelsberg and TRB cultural groupings – overlap geographically with both the areas of primary (or LBK and post-LBK) and secondary Neolithic settlement. This is a period of extensive change (Fig. 15.5), characterised recently in the case of the Chasséen and Michelsberg cultures as 'phénomène d'unification stylistique par interaction de différents groupes'[3] (Demoule *et al*. 2007b, 64). Just when this period begins, as already noted, has only been established to within a margin of a few centuries. Michelsberg culture chronology is central to this question. Typological study provided a probable sequence long ago (Lüning 1967; Biel *et al.* 1998), but precise dating has been more elusive. A combination of typological studies with the anchor of north Swiss-south German dendrochronologies strongly suggests that it must date from at least *c.* 4300 cal BC. Christian Jeunesse in particular (1998; Jeunesse *et al*. 2004; cf. Dubouloz 1998) has argued for slightly earlier beginnings in northern France, as early as *c.* 4500 cal BC, and this too emerges as another important objective for future formal modelling. A clearer picture is emerging from new dating programmes and intensive research on earthworks in northern Germany (Geschwinde and Raetzel Fabian 2009; Müller 2009). There it is now estimated that the Michelsberg culture started *c.* 4200 cal BC at the latest and lasted until *c.* 3500 cal BC. Secure samples stratified in ditches in Braunschweiger Land enclosures date the development from larger to smaller earthworks, which in central Germany are associated with Baalberge pottery. In southern Germany the Bruchsal and Heilbronn enclosures provide a clear picture of later Michelsberg developments, *c.* 3700 cal BC (Seidel 2008a).

So looking forward from the mid-fifth millennium cal BC, we can see not only cultural shifts of diverse kinds but also processes of change in settlement (Fig. 15.5). The demise of nucleated longhouse settlements was followed, except in the Alpine foreland, by a scarcity of identifiable house structures; by other markers of residence or marking of place, often characterised by aggregations of pits on the one hand and enclosures on the other; and by settlement rather more extensively distributed across the landscape. There may have been accompanying subsistence changes, perhaps especially in the location and intensity of cereal cultivation, though this is far from well understood, and nearly everywhere cattle seem particularly important (Auxiette and Hachem 2007; Bogucki 1993; 2000; Ebersbach 2002; Geschwinde/Raetzel-Fabian 2009; Pipes *et al.* 2009; Steppan 2003; Tresset 2000; 2003; 2005a). But there is also much variation in settlement

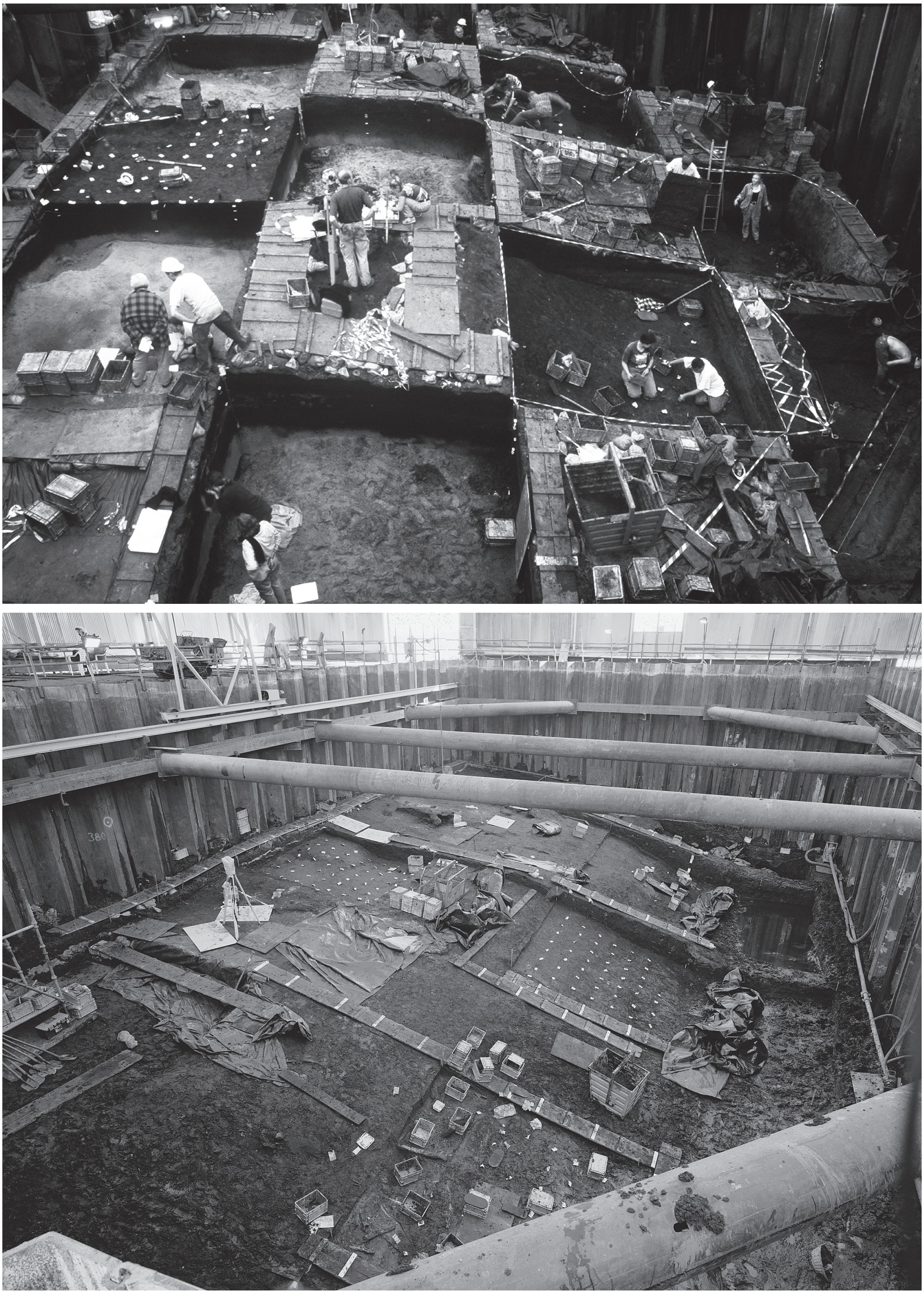


Fig. 15.4. Views of (top) Hardinxveld-Giessendam de Bruin and (below) Hardinxveld-Giessendam Polderweg under excavation. Photos: Leendert Louwe Kooijmans.

histories, and a very brief survey will serve to bring out the diverse nature of the continental foreground.

In southern Scandinavia, early Neolithic settlement was perhaps gradually established from around 4000 cal BC, mainly in the same coastal zones and immediate hinterlands used in the Ertebølle culture; more intense clearance and

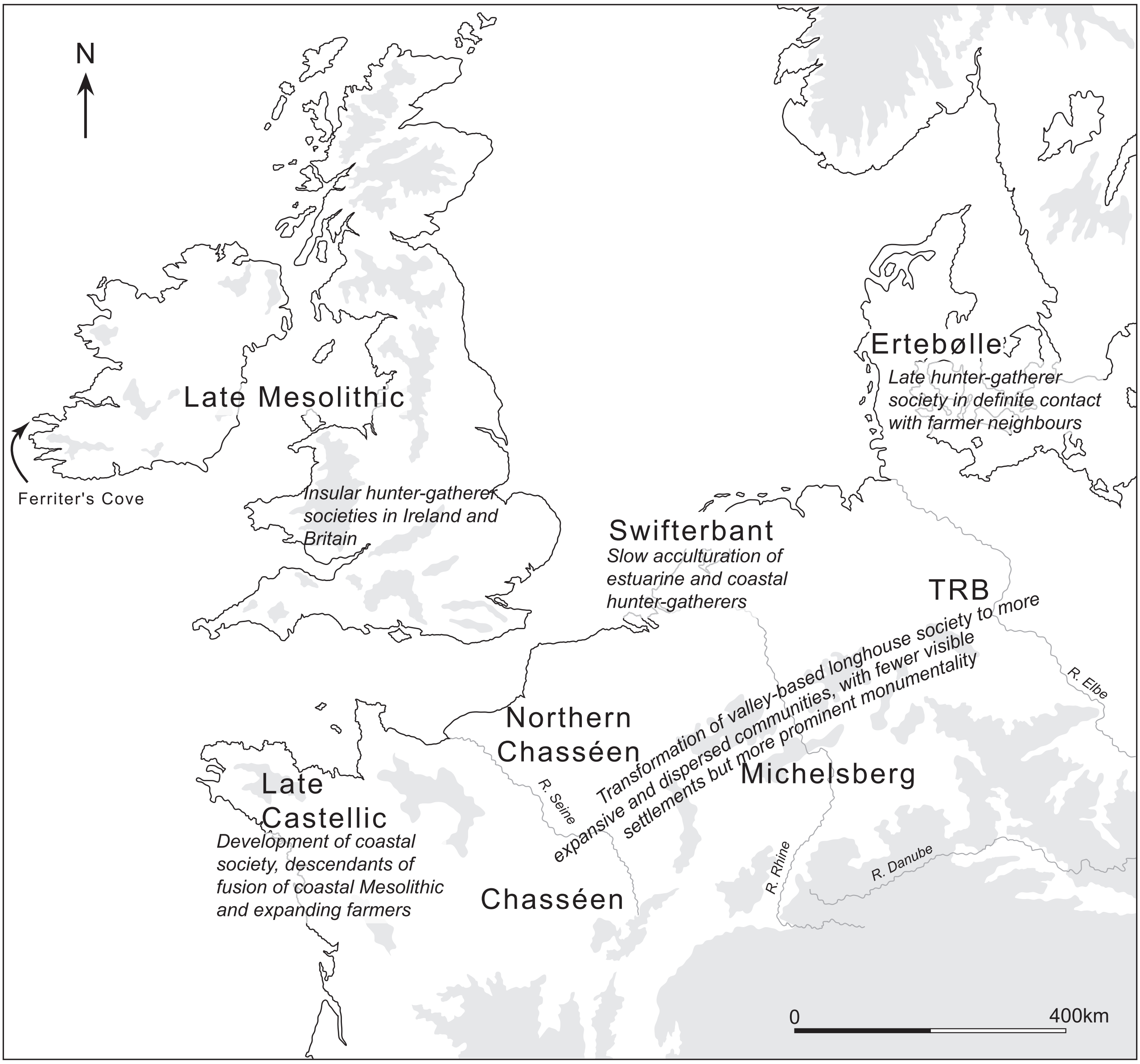


Fig. 15.5. Interpretive, schematic map of selected major features and processes in the cultural landscape of western Europe in the later fifth millennium cal BC.

more frequent monument building appear to belong to the end of the Early Neolithic and beginning of the Middle Neolithic, perhaps *c.* 3500 cal BC (Fischer 2002; Klassen 2004; Ebbesen 2007; Müller 2010a). The same trends may be true of the north European Plain, though Neolithic practices may have begun a little earlier (e.g. Hartz *et al.* 2007; Müller 2010b), and were linked to wider processes of TRB development to the south, in which settlement was normally dispersed and a variety of monuments including enclosures were constructed (Müller 2001; Meyer and Raetzel-Fabian 2006; Midgley 1992; 2005; 2008; Geschwinde and Raetzel-Fabian 2009; Klatt 2009). Overall, enclosures appeared *c.* 3500 cal BC in the northern TRB group contemporary with early megaliths, while non-earthen long barrows had been built since *c.* 3800 cal BC. In Lower Saxony and central Germany the Michelsberg expansion had already produced enclosures *c.* 4200 cal BC.

We can note, as an offshoot of the infill of the north European Plain, the probably late date – perhaps well after 4000 cal BC – at which clearance and monument building began in the northern provinces of the Netherlands, Drenthe and Friesland (Louwe Kooijmans *et al*. 2005; Fokkens 1998, 96–7). In coastal Delfland, further south, Schipluiden has a number of probably contemporary small neighbours in the earlier part of the fourth millennium cal BC (Louwe Kooijmans 2009). Further south again in the Low Countries, Louwe Kooijmans (2007, 297) has referred to Michelsberg expansion, 'remarkable changes' and even 'disruptions', from a date estimated at *c.* 4300 cal BC. It is worth quoting his account at some length:

> It seems that Neolithic society is restructured and that the basic unit shifts to a higher level, from the village in a segmentary society towards groups for which supra-

Fig. 15.6. Part of the enclosure ditch at Spiere-de Hel, West Flanders, Belgium, under excavation. Photo: Bart Vanmontfort.

> local enclosures have a central function, a development seen over wider tracts of western and northern Europe. It is in this stage, to be dated from 4300 cal BC onward, that the wide spaces between the restricted Neolithic enclaves in Belgium are filled in. Apparently both the Blicquy farmers and all final Mesolithic groups transformed into Michelsberg and changed to a new way of life. The Michelsberg complex also demonstrates an expansion towards the north, beyond the loess zone, into the Limburg Meuse Valley and the Münster Basin. This means a northern shift of the old agricultural frontier which must have had its effect on the local communities beyond (Louwe Kooijmans 2007, 297).

In a little more detail, Neolithic axes and adzes had been moved in numbers into the sandy lowlands of Belgium from the sixth into the fifth millennia cal BC (Verhart 2000b, figs 3–4). The enclosure at Spiere-de Hel in the middle Scheldt valley is a good example of Michelsberg settlement expanding within the loess belt of western Belgium (Fig. 15.6), beyond the much smaller enclaves of LBK and post-LBK settlement (Crombé and Vanmontfort 2007; Vanmontfort 2001; Vanmontfort *et al*. 2004). The construction of an enclosure is presumably, as noted above, a significant development in terms of local settlement dynamics, but the pollen evidence does not suggest extensive open ground (Vanmontfort *et al*. 2004, fig. 38) and there were few axes. The subsistence evidence suggests some cultivation, gathering and husbandry, especially of pig. The primary fill of the ditch suggests bank collapse, followed by recuts and gradual accumulation of material. Flint mines are suggested to be another central focus in a new 'hierarchised' settlement pattern (Crombé and Vanmontfort 2007, 268). On the sandy lowland beyond the loess, part of changes informally estimated in this case as 'most probably shortly before or after 4000 cal BC',[4] Michelsberg settlements are harder to find. They were perhaps smaller and more discrete than on the loess belt, and were possibly individually short-lived (Crombé and Vanmontfort 2007, 280); an important new research project on this area is now underway (Philippe Crombé, pers. comm.).

Other regions to the south, both in the Rhineland and in the Paris basin, show many of the same post-longhouse changes. Posthole-defined residential or domestic structures become much rarer, and ditched and palisaded enclosures are a recurrent feature. In some of the loess areas previously occupied by the LBK and its successors, Michelsberg settlement appears sparse (Zimmermann 2006b; 2006c), though in the Rhineland itself both pit sites and enclosures can be both substantial and locally abundant (e.g. Lüning 1967; Biel *et al.* 1998; Steppan 2003; Reiter 2005; Koch 2005; Meyer and Raetzel-Fabian 2006; Gronenborn 2007b). Some areas within the northern Chasséen-Michelsberg cultural complex, such as the Oise, Aisne, 'petite Seine', lower Marne and Yonne (e.g. Dubouloz *et al*. 1991; Lombardo *et al*. 1984) have quite dense distributions of enclosures. The complex enclosure at Bazoches-sur-Vesle, for example, in a side tributary of the Aisne, belongs to a valley landscape where enclosures occur every few kilometres, though it is not clear that these are all contemporary, nor where in the late fifth or early fourth millennium cal BC they may belong (Dubouloz *et al.* 1991; 1997; Dubouloz 1998). Some enclosure sites, on the basis of scattered or individual radiocarbon samples, not yet formally modelled, may not date much before *c*. 4000 cal BC, such as Boury-en-Vexin in the Oise (Lombardo *et al*. 1984). There is new evidence for other enclosures further north towards the Pas-de-Calais (Bostyn *et al.* 2006), and a recent discovery of a large, triple ditched enclosure, whose pottery appears to relate to the Groupe de Spiere, at Carvin 'Gare d'Eau', Pas-de-Calais, north-west of Douai (Cécile Monchablon, pers. comm.). There are other such enclosures in southern Belgium, as at Spiennes, and Spiere itself. Some of these sites are placed in the valley bottoms, like earlier longhouse settlement, and others on the valley sides or plateau edges, which may evoke in part a more extensive use of the landscape than in the longhouse system, and in part the possibility that some of these sites had a defensive role. A recent synthesis evokes things in these terms:

> Il pourrait s'agir, si elles n'avaient qu'une simple function défensive, d'une preuve de tensions émergentes face à

> des terres en raréfaction et à une démographie croissante; ou, à tout le moins, de la mise en place de systèmes idéologiques complexes chargés d'encadrer, par un ancrage manifeste dans le paysage, des communautés toujours plus dispersées dans l'espace (Demoule *et al.* 2007b, 69).[5]

Uninterrupted change or expansion may not characterise all regions. Sheridan (2010) has noted the proposed sequence in Normandy, where there was first settlement expansion estimated to belong to the second half of the fifth and early part of the fourth millennium cal BC, and then at a date informally estimated at *c.* 3800 cal BC, a significant phase of hiatus (Marcigny *et al.* 2007). Another local context not far away, in the lower Eure close to the Seine near Rouen, also suggests a landscape *c.* 4000 cal BC that was far from over-crowded. Occupation in the vicinity of the site of Louviers (Giligny 2005) probably goes back to the early fifth millennium cal BC Villeneuve-Saint-Germain group, but use of the marshy location itself dates to *c.* 4400–4300 cal BC and is associated with the Cerny group. More frequent occupation, of northern Chasséen cultural affiliation, dates to *c.* 4000–3800 cal BC. This was use of wet ground, for passage and discard, and perhaps not principally a settlement in its own right, but the pollen evidence again shows a still well wooded setting (Reckinger 2005), and the animal bones suggest a principal concern with cattle, but also some hunting (Tresset 2005b).

Rather further afield, even if it is probably too far away to be directly relevant to the beginning of the Neolithic in southern Britain, it is worth noting the abundant evidence for southern Chasséen settlement, including again occupation sites with pits, but rare structures, and enclosures (e.g. Thévenot 2005; Vaquer 1990). In the lower Rhône, intensive study between Valence and Orange, for example, has produced a picture in which 'l'économie et la société évoluent vers une occupation du sol plus dense et plus hiérarchisée'[6] (Demoule *et al*. 2007b, 66). Seasonal movements of animals between larger lowland and smaller upland sites have been proposed (Beeching 2003; Bréhard 2007).

In Brittany itself, it is hardly possible to follow such trends in the still scarce settlement evidence, and even the probably increasing numbers of monuments must stand as a very approximate proxy, most of them imprecisely dated (Marchand 2007; Scarre 2007a; Cassen 2009; with references). In central-west France, between the Loire and Gironde, enclosures become numerous from a date estimated to start probably in the first half of the fourth millennium cal BC, in the Néolithique récent of the region (Burnez and Fouéré 1999; cf. Cassen and Scarre 1997); possibilities of some dating to the Néolithique moyen, because of comparisons in form to those in the Paris basin and elsewhere, have not yet been confirmed (Burnez *et al.* 2001; Semelier 2007). The enclosures are the most obvious manifestation of a settlement infill much more marked than in the fifth millennium cal BC (Marchand 2007; Scarre 2007a).

The possible scale and nature of colonisation

So this wide range of evidence suggests various possibilities. There is much diversity, and there are so far unresolved questions of chronology. There is probably no compelling evidence for unmanageably populous landscapes along the breadth of the continent facing Britain, which might have generated large-scale population movement. On the other hand, there is no reason to exclude small-scale, piecemeal and perhaps episodic fissioning from continental communities, in a context to be generally characterised as one of change, which locally, as in western Belgium, appears to have been quite dramatic in terms of settlement expansion. Climate change has also increasingly been invoked as a causative or enabling factor (e.g. Gronenborn 2007a; 2007b; Strien and Gronenborn 2005; Bonsall *et al.* 2002; Tipping 2010), but we would like to see much greater precision in defining both claimed effects and their timings. The record in the Alpine foreland suggests a correlation between periods when Neolithic settlement is abundant and phases when lake levels were low and climate was warm and rather dry, and conversely between periods when Neolithic settlement appears more sparse and phases when lake levels were high and the climate was wet; these periods of higher water table are dated to 4000–3950 BC and 3700–3250 BC (this phase is composed of three successive events centred on *c.* 3600 BC, *c.* 3500 BC and *c.* 3350 BC) (Arbogast *et al.* 2006). Raised bogs in the north-east of the Netherlands also show a correlation between significant rises in atmospheric radiocarbon ($\Delta^{14}C$) and increasing wetness, at dates estimated at *c.* 4005–3935, 3665–3615, 3545–3485 cal BC and so on (Blaauw *et al.* 2004, table 1). It would be foolish to claim that there could be no effects on human activity from such shifts, given the subsistence and settlement changes in colder and wetter phases in the Alpine foreland, but on present timings they could prove to be more relevant say to the spread of enclosure construction across southern Britain than to the initial introduction of Neolithic things and practices, including cereal agriculture.

Can we refine a colonisation hypothesis any further? After all, previous recent versions have been based in large measure – apart from the arguments for timescales reviewed above – on the assertion of the isolation of Mesolithic Britain and Ireland from the continent and the scale of differences in material culture and other practices. It is hard to ignore the point of Thomas (2008), noted above, about material 'selection and recombination'. As Richard Bradley has put it (2007, 86):

> In principle, it should be possible to define the source, or sources, of any migrants through a close comparison between the material culture of Neolithic Britain and Ireland and its counterparts on the European mainland. Although there are a number of general similarities, particularly among the undecorated ceramics which are the earliest in these islands, attempts to define more exact links have so far failed. That is probably because the study area would have been accessible from so many different areas of Continental Europe.

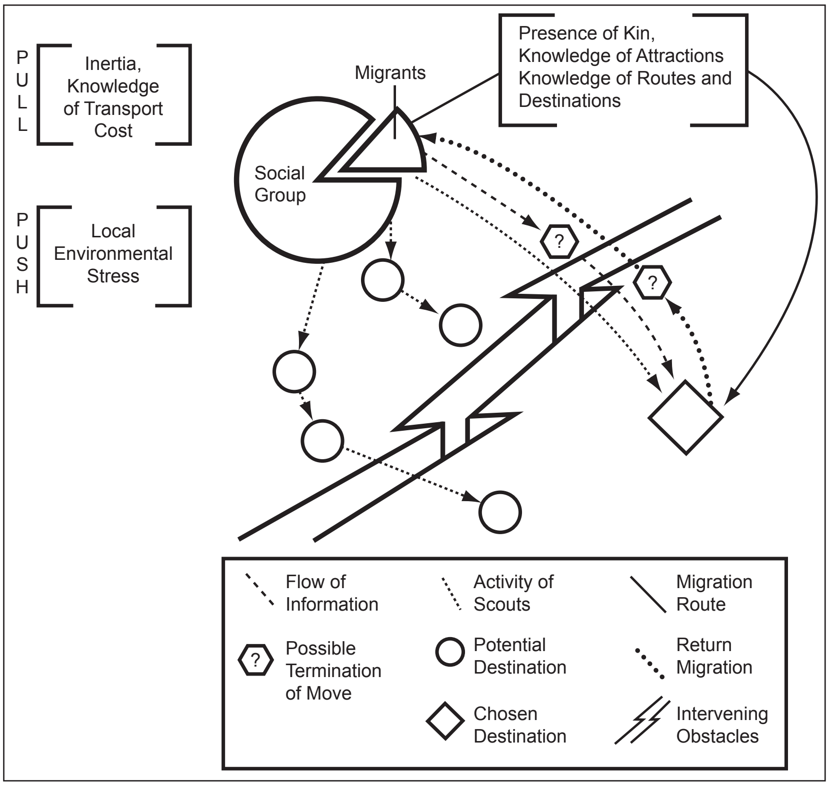


Fig. 15.7. A long-distance colonisation model: redrawn from David Anthony (1990).

The response of Sheridan (2007a, 468), while asserting the general affinity of Carinated Bowl pottery to the ceramic tradition of the Michelsberg culture, has been to evoke the likely existence of an exact or closer match in so far under-researched parts of northernmost France: in Nord-Pas de Calais and northern Picardie. So far, as it stands, that argument seems less than convincing. There remains little good evidence for the wholesale transference of continental cultural practices. If we look to the Michelsberg culture, for example, even close to north-east France, we only see partial overlap in the material repertoires. The enclosure site, noted above, of Spiere-de Hel in the middle Scheldt valley in Flanders – only a little over 100 km from the Kent coast, and rather less from the French border – is a good example. It is estimated to date to *c*. 4000 cal BC (Vanmontfort *et al*. 2004). Its pottery and flint assemblages include deep-necked jars and shouldered and even carinated bowls, and polished axes, scrapers and leaf-shaped arrowheads (e.g. Vanmontfort *et al*. 2004, figs 25–7 and 32–5), which would not look out of place in southern and eastern British assemblages of the earlier fourth millennium cal BC, but they also include other jar and bowl forms, and triangular points and long edge-retouched pieces, which certainly would.

Do we then revert to a notion of incomers from much more generalised source areas, as Bradley has proposed? There has been remarkably little theorising about the possible nature of colonisation in this British and Irish debate, despite the number of times the issue has been argued over. Perhaps only Humphrey Case (1969) really got to grips in detail with some of the basic issues, arguing that the conditions of exploration, by journeying individuals, and then subsequent initial establishment, in pioneering conditions by small groups, would have led to disruption of material traditions. That view was subsequently either criticised (e.g. R. Bradley 1984a, 9–14) or lost sight of altogether. A more general view of 'wave of advance' movement generated by demographic increase and proceeding by short steps at the frontier was proposed by Ammerman and Cavalli-Sforza (1984). Drawing on a much wider literature, David Anthony (1990; 1997; Fiedel and Anthony 2003; cf. Rouse 1986; Chapman and Hamerow 1997) has proposed a more general model for long-distance migration (Fig. 15.7), as opposed to short-distance migration akin to 'wave-of-advance' movement, in which 'in general, migration is most likely to occur when there are negative (push) stresses in the home region and positive (pull) attractions in the destination region, and the transportation costs between the two are acceptable' (Anthony 1990, 899). Push factors for long-distance migration are normally economic, often by people with 'focal' rather than broad-spectrum economies , though ideological and other factors are not to be discounted (Anthony 1990, 898–901). In agreement with the view of Case, colonisation is usually preceded by scouting, and where colonisation takes place is strongly contingent on where scouts happened to go (Anthony 1990, 902–3); 'migrants are not likely to move to areas about which they have no information' (Anthony 1990, 901). It is rare for whole cultures to move, and normal for budding off, fissioning and other kinds of selection to take place; 'cultures don't migrate; people do' (Anthony 1997, 27). 'A migration stream often flows from a highly restricted point of origin' and 'the pool

Table 15.1. Posterior density estimates for the appearance of selected Neolithic things and practices at various geographical scales, derived from the models in Chapter 14.

Study area	**Area within study area**	**Region within area**	**Parameter**	***Posterior density estimate (cal BC) (95% probability)***	***Posterior density estimate (cal BC) (68% probability)***
Southern England and Wales			Fig. 14.59: *start Neolithisation*	*4235–3985*	*4115–4010*
	South-east England		Fig. 14.57: *start SE Neolithic*	*4075–3975*	*4035–3990*
		Greater Thames estuary	Fig. 14.49: *start Thames estuary*	*4315–3985*	*4145–4005*
		Sussex	Fig. 5.32: *start Sussex Neolithic*	*4065–3815*	*3990–3855*
		Eastern England	Fig. 6.50: *start eastern Neolithic*	*3845–3695*	*3800–3730*
	South-central England		Fig. 14.57: *start S central Neolithic*	*3975–3835*	*3930–3855*
		Middle Thames valley	Fig. 14.50: *start middle Thames Neolithic*	*3860–3700*	*3810–3735*
		Upper Thames valley	Fig. 14.51: *start upper Thames Neolithic*	*3915–3740*	*3860–3795*
		North Wessex	Fig. 14.52: *start north Wessex*	*3930–3665*	*3805–3685*
		South Wessex	Fig. 14.53: *start south Wessex*	*4065–3705*	*3905–3735*
		Cotswolds	Fig. 9.29: *start Cotswold Neolithic*	*4035–3845*	*3985–3890*
	South-west Britain		Fig. 14.57: *start SW Neolithic*	*3855–3735*	*3820–3760*
		South-West peninsula	Fig. 10.30: *start Neolithic settlement*	*3940–3735*	*3855–3765*
		South Wales and the Marches	Fig. 11.10: *start S Wales & Marches*	*3765–3655*	*3725–3675*
Isle of Man			Fig. 14.148: *start Manx Neolithic*	*4040–3700*	*3905–3725*
Ireland (model 2)			Fig. 12.54; *start Irish Neolithic (model 2)*	*3750–3680*	*3730–3695*
Ireland (model 3)			Fig. 12.56; *start Irish Neolithic (model 3)*	*3850–3740*	*3815–3760*
Scotland S of Great Glen					
	S Scotland		Fig. 14.150: *start S Scotland*	*3835–3760*	*3815–3780*
	NE Scotland		Fig. 14.154: *start NE Scotland*	*3950–3765*	*3865–3780*

of potential migrants is kin-defined, often quite narrowly'; this narrow selection combined with innovation in new lands can lead to 'rapid stylistic change from what was in any case a narrowly defined pool of variability' (Anthony 1990, 903). Contact is usually maintained between colonisers in their new lands and their source areas, over considerable periods of time subsequently; 'migrations almost always move in two directions: the initial migration is followed by a counterstream moving back to the migrants' place of origin' (Anthony 1990, 897–8). In addition, migration streams can continue to operate in a given direction even though initial circumstances have changed (Anthony 1990, 904).

This scenario raises interesting possibilities. Should we think of potential cross-Channel movement at the very end of the fifth millennium cal BC as short-distance or long-distance? In favour of the latter is the planning normally required (and so well evoked by Case 1969) for moving across an ecological or cultural boundary (Anthony 1990, 902), which the Channel surely constitutes, and the fact that 'local moves would have only subtle effects on material culture' (Anthony 1990, 901), which should mean that we would find an uninterrupted continuation of Michelsberg culture practice in south-east England – which is clearly not the case. The review of continental settlement above may suggest possible specific economic motives, such as a desire for more land, but also a strong general sense of change and expansion. In this regard, the contemporaneity of many aspects of the south Scandinivian and northern German Neolithic sequence with the British early Neolithic is remarkable, despite the lack of shared material culture. An explanation is necessary and in both supra-regions this could well be due to processes in continental Europe.

If we cannot accurately pin down cause or causes, can we reflect further on the structure of this possible migration, as Anthony recommends (1990, 899)? There is no specific evidence so far for contact between the continent and late Mesolithic communities in south-east England, unlike the situation in the Dutch estuaries or the Ertebølle culture. One possibility would then be to regard the earliest Neolithic activity in south-east England as defined in this volume as just such a phase, as far back as the later 41st century cal BC (Fig. 14.54: *start Thames estuary*; Fig. 14.57: *start SE Neolithic*; Table 15.1). Continuation of the migration stream could have followed in the 40th century cal BC (e.g. Fig. 14.54: *start Sussex Neolithic*), as further scouting and then settling established new areas of Neolithic activity in central-southern England (e.g. Fig. 14.54: *start Cotswold Neolithic*), in what Anthony calls 'chain migration' (1990, 903). Continuing contact with source area or areas could well be symbolised in the flow of jadeitite axes into Britain, as Sheridan has argued (2010), though their origin was far from the immediate continental hinterland over the Straits of Dover. Indeed, we could even contemplate whether the putative migration stream was maintained until the 38th century cal BC, bringing first the idea of building long barrows and cairns and in the end the idea and practice of constructing enclosures.

We need to keep firmly in view the particularities of

this archaeological situation, while being guided by general migration theory of the kind discussed above. Though we do not have specific evidence of continental-insular pre-Neolithic contact in southern Britain, we do know (or think we know) that there were fifth millennium cal BC late Mesolithic communities (e.g. Jacobi 1978; Holgate 2003; Cotton 2004). Putative newcomers did not come into an empty land. Though we do not know when the Chestnuts monument was built in the Medway valley close to Coldrum (J. Alexander 1961), it may be significant that this was in a place with evidence of late Mesolithic activity, as was also the case at the middens of Ascott-under-Wychwood and Hazleton (Benson and Whittle 2007; Saville 1990). Similarity in settlement location around the fens may also suggest continuation of indigenous knowledge (Edmonds *et al*. 1999). So we could in fact envisage fusion and integration from a very early stage, from which perspective the attempt to keep colonisation and acculturation apart as separate processes might be to miss the character of this transformation entirely. Pottery, leaf arrowheads, deep flint mining, rectangular houses, cereals and domesticated animals could all be listed as innovations from the outside (though substantial houses were rare on the continent at this time, as at Beaumont, Puy-de-Dôme, or closer, at the large ditched and palisaded enclosure of Mairy, Ardennes: Demoule *et al*. 2007b; Marolle 1998), but how to dwell in the landscape may have been another matter. Tim Ingold (2000, chapter 8) has contrasted two forms of identity, one genealogical, based on origins, and the other relational, based on practice involving other people and things; the latter has proved a useful perspective in discussion of eastern Scotland (Warren 2004, 91) and can be adopted here as well. And there are early features, such as the construction and use of the stone monument at Coldrum, which are not easily linked to pre-existing practice on the immediately adjacent continent; though recent salvage excavation at Beaurieux in the Aisne valley has revealed two graves holding individuals, one with stones enhancing a wooden coffin, within a narrow enclosure 15 m long, and one or two other similar examples are known in the Marne and Yonne (Colas *et al*. 2007; Demoule *et al*. 2007b, 73; Thevenet 2008). The Coldrum construction may best be seen as the product of local circumstance.

Long-distance migration theory predicts continuing migration streams, as explored above. Sheridan has proposed small incoming communities (2010; Pailler and Sheridan 2009). Could we be dealing in fact with a very small-scale situation? What has not been brought into account so far is timescale. Where it has been possible to model the chronologies of selected long barrows and especially causewayed enclosures with some precision those often prove to be very short-lived: the product of specific generations. Could this also not be the case with the start of the Neolithic in south-east England? In this perspective, a different view of the range, structure, cause or causes, continuing contact, artefactual variability and continuing effects potentially involved (cf. Anthony 1990) would result. A small founder pool, operating say over only one or two generations, making a planned Channel crossing over its narrowest point and into the Greater Thames estuary, following from initial scouting, would be enough to initiate changes; motivation could be sought in the general conditions of change on the continent, but perhaps becomes a less central issue. A small-scale initial process, perhaps a rather low-key event in the grander continental scheme of things, would have allowed fusion and integration with indigenous population, which might otherwise be expected to have remained archaeologically visible in southern Britain into the early part of the fourth millennium cal BC.

The next steps

Over the following generations, the next steps were perhaps a further combination of 'chain migration' (Anthony 1990, 903) and acculturation as Neolithic things and practices spread gradually into south-central England, probably by the latter part of the 40th century cal BC (Fig. 14.58: *start S central Neolithic*), and then into south-west Britain by the second half of the 39th century cal BC (Fig. 14.58: *start SW Neolithic*; Table 15.1). This general spatio-temporal trend of Neolithic things and practices spreading westwards across southern Britain (Fig. 14.58), may mask a more nuanced, multi-focal story (Fig. 14.54), which unfortunately cannot be reliably revealed by the quality and quantity of our current data. Ascott-under-Wychwood and Hazleton have already been cited as places where early Neolithic middens were accumulated at spots in the landscape in which there had been Mesolithic activity, though we do not need to claim direct continuity; the Fir Tree Field shaft is another location with a similar succession. The construction of the Post and Sweet Tracks in the Somerset Levels in the very late 39th century cal BC, in an area of previous vegetational disturbance, could be another. Situations like these may suggest continued use of familiar, remembered places by an indigenous population. There is comparatively little sign of preceding Mesolithic activity on sites occupied in the early fourth millennium cal BC in the upper and middle Thames valley, though use of tree-throw holes, small pits, some middens and occupation spreads can be cited, as well as a large rectangular timber house at Yarnton (Hey and Barclay 2007). At Raunds in the Nene valley, the long mound was built at a confluence repeatedly visited during the Mesolithic, probably into the fifth millennium cal BC (Harding and Healy 2007, 47), and there is other Mesolithic activity in the wider area (Harding and Healy 2007, 47–8). There is evidence for Mesolithic activity on the southern chalk downland as a whole (Lawson 2007), but often at quite low densities, for example in north Wiltshire (McFadyen 2006, 131–4), and it has been suggested that Neolithic activity represents an infill of this kind of region (Whittle 1990b). A very different history, exemplified in the Fir Tree Field Shaft, may have been played out in Cranborne Chase to the south, with its numerous and abundant flint scatters spanning the whole of the Mesolithic (M. Green 2000, 20–8).

A postulated spread of Neolithic practices from the south-east would predict a slightly longer survival of late Mesolithic communities in both western and northern Britain. In the present state of evidence, this is hard to evaluate rigorously, and has anyway been beyond the remit of this project. There appears to be some preliminary support for this possibility in the radiocarbon dates for late Mesolithic activity at March Hill, Yorkshire, associated with rod microliths (Spikins 1999; 2002), and at South Haw, Yorkshire, with similar associations as well as with scalene triangles (Chatterton 2007). The evidence reviewed in Chapter 11 for the Gwent Levels in south-east Wales might also be compatible with a very early fourth millennium cal BC date for late Mesolithic activity, but so far inconclusively so. But clearly, many more such studies are needed.

Neolithic activity in south Wales and the Marches probably began in the generations around 3700 cal BC (Fig. 11.10: *start S Wales & Marches*), though the broader estimate for south-west Britain as a whole is closer to the generations around 3800 cal BC (Fig. 14.59: *start SW Neolithic*; Table 15.1). The two scales are revealing. On the one hand, the estimate for south Wales alone, based on fewer data, reminds us of the probable lag between initial events in the Greater Thames estuary and final establishment to the west. On the other hand, the broader-scale estimate for the time when the first Neolithic practices appeared in south-west Britain is comparable with those for the Isle of Man, Ireland (apart from Magheraboy in our preferred model 3) and southern and north-eastern Scotland (Figs 14.176–7, Table 15.1).

The closeness of these five date estimates is striking. It is legitimate to see them as connected (Fig. 15.8). They take our story on from a simple date estimate for the start of the Neolithic in south-west Britain. At the same kind of date, probably in the later 39th century cal BC, over the span of a few generations – perhaps of a single human lifetime – Neolithic things and practices were being established in south-west Britain, in north-eastern Scotland, and in southern Scotland. Perhaps a decade or two later, in the earlier 38th century cal BC, they appear in Ireland (model 3). Probably in this century they also appear in the Isle of Man (although the imprecision of our date estimate here reflects the particular paucity of data from the island). If our regional date estimate for the start of these practices in the south Wales and the Marches is reliable (and it is a small region with a consequently limited dataset), then the first Neolithic may have appeared here two or three generations later than elsewhere. After what appears to be a rather slow, perhaps piecemeal, spread across southern Britain, from the south-east, there is a significant gear-shift in the tempo of change: an impressive acceleration. As with all our estimates for the start of the Neolithic, we could wish for more radiocarbon dates on appropriate samples from individual sites, perhaps especially for Ireland, but the estimates for Scotland are based on a number of impressive recent projects, and should be reliable. What we have not been able to bring into account, being beyond the remit of the project, are estimates for the start of Neolithic activity in the Midlands, the north of England and north Wales, but preliminary modelling of newly available data, such as from the Milfield basin in north-east England (Johnson and Waddington 2008; Passmore and Waddington forthcoming), suggests provisionally that the same kind of date ranges will emerge (Griffiths forthcoming).

What kind of process applies at this point, and why now? Whereas the beginnings could have been the outcome of small-scale movements of newcomers from the continent and ensuing fusion with indigenous people, followed by a gradual spread across southern Britain, this marked acceleration from the later 39th century cal BC seems to demand a different explanation. Various possibilities present themselves. Given the areas involved, the apparent rate of spread increases significantly. Demographic expansion, spreading outwards by some kind of wave of advance, seems too simple, since the settlement record nowhere suggests an over-crowded landscape, and unrealistic, since the rates of demographic increase would have to have been unfeasibly high, as noted also for central and western Europe (Robb and Miracle 2007, 111). Perhaps some kind of critical mass, however, could have been achieved. Further filtered colonisation, including by boat, up and around the coasts of England and Scotland, is another possibility, and could have reflected ongoing social and other changes to the south. The early construction of long barrows/rectilinear mortuary enclosures in Scotland is a striking development compared with existing indigenous practice, and one that seems to have appeared early and rapidly in both southern and north-east Scotland (with examples from Eweford and Pencraig Hill in East Lothian, and Forest Road, Kintore, Aberdeenshire). Their existence marks a sharp break in regional terms, and one way to see these is to refer them to emerging monument traditions further south, to which we will return below.

Another interpretation, however, is of change now being accepted by indigenous communities and spreading rapidly through existing social networks. Perhaps again, both processes were at work, with chain migration, local acculturation, and continued contact with source areas (in this case now in southern Britain, as well as on the continent) all contributing to the situation. Perhaps the now local proximity of new worldviews and beliefs led to the acceleration in their uptake. And again, process or processes need not have been uniform everywhere. In eastern Scotland, for example, detailed study of the lithic industries of the fifth and fourth millennia suggests marked difference between late Mesolithic and early Neolithic traditions, in terms not only of forms, but also of production techniques and raw materials; moreover, many more early Neolithic sites have been found than late Mesolithic ones (Warren 2001; 2004; 2005). So it is far from clear here that any overall argument for direct continuity could plausibly be defended. Similar difficulties apply in Ireland, when late Mesolithic and early Neolithic lithic traditions are compared (Cooney 2007a). On the other hand, we can bear in mind the observation of far-reaching cultural re-

alignments, as in the case of the Chasséen and Michelsberg cultures (Demoule *et al.* 2007b, 64), even where there is no need to evoke new population from the outside.

When comparisons of this kind are made, in terms of lithic traditions and overall settlement distribution, it is normally the case that generalised blocks of time are contrasted one with the other: an overall sense of the late Mesolithic versus a unified model of the early Neolithic. What is actually normally being compared is the outcome of centuries of early Neolithic activity, rather than the specifics of altering situations in, say, the 39th century cal BC or the 38th century cal BC. One intriguing example concerns the development of Carinated Bowl traditions in north-east Scotland. One view has been that the sequence begins with a traditional Carinated Bowl style, to be followed quite shortly by the variants of the North-East Carinated Bowl and modified Carinated Bowl styles (summarised by Sheridan 2007a). Our models suggest variation from the outset (Fig. 14.165). How does this view fit the possible processes mooted? Does it promote an idea of separate streams of migration? This seems unnecessarily complicated, from the general perspective offered above (Anthony 1990). Or would it not suit better a scenario in which existing regional identities were maintained, and transferred – quite subtly, given the muted differences between these styles – into the new medium of pottery? It is worth remembering the proximity of Balbridie and Crathes: on either side of the river Dee, the former with North-East Carinated and the latter with traditional Carinated Bowl pottery. Could there also be a similar story behind the different pottery in south-west England?

So, as far as possible in the present state of analysis, we need to try to track specific trajectories of change. Two further examples illustrate the possibilities. Beyond the area of our analysis in Chapter 14, it has been suggested that the continuation of late Mesolithic communities can be detected on smaller islands further offshore like Oronsay into the earlier fourth millennium cal BC, at a time when Neolithic activity was being established on the innermost islands, like Islay, and on the western mainland coast (Mithen *et al.* 2007, 518). Precise chronologies for these, potentially contemporary as well as adjacent, activities have the potential to shed further light on the dynamics of the transition. Secondly, and directly modelled in this project, there is the date of timber halls and houses. In southern and north-east Scotland, the large timber halls do not appear to belong to the first generations of the Neolithic, but rather to those of the children and grandchildren of the pioneers (Fig. 14.175). These substantial structures are probably not numerous, though more may well remain to be detected (Brophy 2007), and the use-lives of Balbridie, Crathes and Claish were relatively short (Fig. 14.173); all three were burned down, possibly deliberately (Brophy 2007). So here there is dramatic new practice, which occurs from place to place within southern and north-east Scotland, as new practices were becoming established. Was this a new idea brought by incomers, who did not have the resources to build until their economic base had been established? Or was it an innovation adopted by local people from what they had heard of (and possibly seen) through social networks extending southwards? Perhaps it will remain impossible to separate these possibilities, and the enduring significance of these buildings could have been to bring sizeable numbers of people together, perhaps of varying descent, for construction (cf. Startin 1978), use and perhaps also the spectacle of their death by fire (cf. Tringham 2005). But this practice only belonged to a restricted horizon, and cannot be used to generalise conditions in the early Neolithic as a whole in Scotland south of the Great Glen. It may evoke either acts of display by incomer communities, or a means of integration for people of varying history and descent. We cannot exclude either possibility in the current state of understanding, and it is possible that such enterprises in this kind of context could have had ambiguous meanings. One study of the construction of a ceremonial longhouse in lowland Papua New Guinea showed how the structure, built to repair an alliance, was conceived of differently by the two groups in question: outwardly a place of reconciliation for the builders, but a potentially hostile and threatening setting, given materials evoking dangerous substances, in the eyes of the others (Strathern and Stewart 1999).

Rectangular timber houses in Ireland were also built and used within a restricted timeframe (Fig. 15.9). These were in use, depending on our preferred interpretation, for either a century or so, or less than a century, from the late 38th century cal BC into the 37th century cal BC (Figs 12.22–7 and 12.28–9). In model 3, they belong a little after first beginnings, whereas in model 2 they follow closely on the start of the Neolithic in Ireland, more in line with the probable situation in Scotland. Models 2 and 3 cannot both be right, and given our inclination to favour model 3, the implications for the discussion here could be, first, that the process of first Neolithic beginnings in Ireland took a few generations, and secondly, that we cannot use evidence from the 37th century cal BC to infer conditions in the century or so before.

So we have offered a scenario and variants which we believe best fit the emerging chronology for the timing and successive appearance of the Neolithic over much of Britain and Ireland, beginning in south-east England probably in the 41st century cal BC, particularly the Greater Thames estuary, then spreading gradually, possibly piecemeal, into south-central England by the 40th century cal BC, and expanding thence much more rapidly, from the 39th century cal BC into the 38th century cal BC, into south-west Britain, Scotland south of the Great Glen, Ireland and the Isle of Man (Fig. 14.176). The appearance of Neolithic things and practices in the Midlands and northern England may belong to this period (Griffiths forthcoming), while in south Wales and the Marches these innovations may have appeared as late as the last decades of the 38th century or first decades of the 37th century cal BC (Fig. 14.54). Given the location of initial changes, and the range of material and other transformations, we think that this process was probably initiated by small, possibly fragmented or filtered groups from the adjacent continent, but it also seems very

likely that indigenous communities were drawn into the process of change very soon, and perhaps even more or less from the outset. We could envisage indigenous people being attracted to the novelties, among others, of domesticated animals and fine artefacts, and thus rapidly drawn into the adoption of Neolithic things and practices; and the very momentum of new lifeways and beliefs in general, with their links to a wider world, could have attracted indigenous people to adopt the ways of incomers, now present in the same land. The pace of change appears to accelerate in the later 39th century cal BC, which may evoke a different combination of factors, perhaps involving principally a greater participation by indigenous communities in the areas around the regions of primary change. Taken at face value, it is hard to accommodate the very early dating of Magheraboy in this kind of scenario, and in terms of the colonisation theory reviewed above this would have been a very unusual, high-risk, and extremely long-distance migration. With the 'forcing' described and discussed in Chapter 14, however, it is perhaps possible – just – to accommodate the current dating of this site in the kind of narrative just offered. For the present, in the expectation of further dating of Magheraboy and other sites in Ireland, we shall have to leave this as a loose end, and perhaps also as a reminder that the story need not be single-stranded, as Alison Sheridan in particular has argued many times.

Alternative explanations

What then of the arguments for indigenous acculturation, set out in their purest form by Julian Thomas (1999; 2003; 2004a; 2004b; 2007a; 2008)? We have tried to accommodate perhaps his most fundamental point, that it is hard to find correspondence between material assemblages in Britain and plausible single source areas on the continent, with the model discussed above of initial, small-scale colonisation from a restricted source area. Further, with a longer and much more differentiated timescale now for change within the first centuries of the Neolithic in Britain and Ireland, diversity in monument traditions for example can much more easily be referred to development within the offshore islands, rather than to an eclectic and heterogeneous range of sources right across north-west Europe. We agree with his view, *contra* that of Sheridan, that there was probably more contact between late Mesolithic communities in southern Britain and Neolithic communities on the adjacent continent in the fifth millennium cal BC than currently meets the eye, but this is not for us the smoking gun that it represents for both Thomas and Sheridan, given the evidence from central and western Europe in the sixth and fifth millennia for the rather variable effects of proven contact between farmers and hunter-gatherers. We have also accommodated the case for the contribution of indigenous population to the whole process, but now in a much more specific set of scenarios.[7]

Over the past decade, the acculturation hypothesis has begun to look insufficiently supported by precise chronology, relying in latter statements on an assertion of rapid initial change followed by subsequent slow development. Neither part of that claim is now consistent with the patterns revealed in Chapter 14, and we go on below further to explore the pace of change in later centuries, especially in the 38th and 37th centuries cal BC. And the acculturation hypothesis has not so far adequately specified why change should have been initiated when it was – according to our models now, from the 41st century cal BC. Could we, however, not now run the sequence again, as it were, with the acculturation hypothesis as the dominant explanation of changes? Would this look more convincing if supported by a more precise timescale?

One way in might be by resort to the wider picture of continental change. Julian Thomas (1996) has proposed a gradual process of 'mesolithisation' of the primary Neolithic in central and western Europe, whereby elements of both an indigenous worldview and indigenous practice, including residential mobility and use of wild resources, would have been absorbed by primary Neolithic communities, resulting in the rather different character of post-Danubian cultures. A similar idea had already been proposed by continental archaeologists before radiocarbon dating was widely practised (e.g. Sangmeister 1960). This seems too simple. It reduces considerable diversity to a single idea. In particular, it is hard to show any clear or single trend to increased use of wild resources in the TRB-Michelsberg-Chasséen orbit. There was perhaps an earlier fifth millennium emphasis on wild animals in certain contexts, particularly mortuary ones (Sidéra 2000; 2003), and in probably mid-fifth millennium late Lengyel trapezoidal longhouse contexts in central Poland, at sites like Brześć Kujawski and Osłonki (Bogucki 2000), a very broad spectrum of resources were used. But cattle are dominant in the succeeding horizon further south in Poland at Bronocice (Pipes *et al*. 2009), and variously cattle and pig in northern French contexts of the later fifth and earlier fourth millennia (Arbogast 1994; 1998; Arbogast *et al*. 1991; Tresset 2000; 2003; 2005a; Tresset and Vigne 2006; 2007). The Alpine foreland trend is towards increased use of domesticates by the middle to later fourth millennium BC, after complex and shifting mixes of wild and tame in the faunal assemblages of the late fifth and earlier fourth millennia BC (e.g. Schibler *et al*. 1997a; 1997b; Ebersbach 2002). Changes in residential patterns are another matter. Certainly the end of the longhouse is a striking development, but on the one hand the longhouse system probably involved complex individual movements at varying scales (summarised in Whittle 2009), and on the other it is not clear at all that the later fifth millennium pattern of generally dispersed settlement, with large structures little visible archaeologically, combined with enclosures and other monuments as some kind of centralising or integrating place, should be referred to residentially mobile hunter-gatherers.

A different kind of shift and sequence could be proposed. This would involve a notion of social networks or some kind of communication and mutual awareness among later Mesolithic communities in Europe. There is now a discernible sequence in the transformations around the

primary Neolithic of western and central Europe, region by region, and all, it could be argued, with substantial or dominant indigenous involvement. Things began to shift first in the Dutch estuaries, as described above, from around 5000 cal BC. The start of the Neolithic in Brittany began perhaps by the middle of the fifth millennium cal BC. The Neolithic sequence in the Alpine foreland begins around 4300 BC (Menotti 2004). Change in the Dutch estuaries was much more established by around 4000 cal BC, and came to the north European plain perhaps a little earlier, and about the same time to southern Scandinavia (Hartz *et al*. 2007; Larsson 2007; Müller 2009). Could there be a kind of domino effect in this sequence? There is no reason to suppose direct connection between the Dutch estuaries and Brittany. The Alpine foreland may seem remote and detached, though shells from the Atlantic coast are known in early fourth millennium BC contexts (Dieckmann *et al*. 1997), and the movement of Alpine jadeitite axes from the fifth millennium onwards also speaks for the possibility of long-range contact. There is much more reason to see a nexus of interaction from the Baltic to the Dutch estuaries, though the Swifterbant culture need not be seen simply as an offshoot of the Ertebølle culture. The convergence of transitions in the late fifth millennium cal BC, from the Rhine-Meuse estuary, if not also the Scheldt, round to the southern Baltic, would be one way to explain the indigenous initiation of new practice in south-east England in the 41st century cal BC. An alternative approach would be to accept the role of indigenous late Mesolithic communities on the northern European plain and in southern Scandinavia as the basis for further developments, but nonetheless to argue that agrarian societies to the south – the Michelsberg and late Lengyel phenomena – enhanced the clear cultural pressure on changing northern practices, and that the arrival of ideas through networks and individuals brought an end to Mesolithic lifestyle, both in Britain and southern Scandinavia.

So an argument can be constructed for convergence in the timings of 'going over'. This need not imply that the motivations for transformation were the same everywhere. Larsson (2007) has mooted the possibility for southern Scandinavia of a change in perception, conditioned by shifting environmental and physical conditions, such as sea level alterations and elm disease. But social relations could have been substantially different in these two regions. In southern Scandinavia there is convincing evidence from the Ertebølle culture for 'a social structure on par with the Neolithic societies to the south. They were incorporated in a widespread interregional network, with the exchange of exotic objects as symbols of social prestige within ranked societies' (Larsson 2007, 601). Indeed, Anders Fischer among others (2002; cf. Jennbert 1984) has proposed a model of late Ertebølle emulation and competition, with the supply of imported exotics making it harder and harder to 'obtain material symbols of power in the form of portable objects alone. Socially ambitious groups became engaged in the new economies, driven in significant part by social and ceremonial feasting' (Larsson 2007, 601). In southern Britain, however, the evidence is very different. Nothing in the late Mesolithic archaeology of lowland Britain, including in south-east England in particular (e.g. Cotton 2004; Cotton and Field 2004; Holgate 2003; Champion 2007), really suggests the kind of situation found on the shores of the Baltic, although all of the surviving sites here would have been inland (Shennan and Horton 2002) so that it remains theoretically possible that coastal occupation might have taken a form closer to the Baltic one. But instead, one might model residentially mobile, undifferentiated and small-scale communities. It could be tempting from such evidence for the late Mesolithic in southern Britain to think in terms of the values and worldview proposed for hunter-gatherers by Alan Barnard (2007; cf. Helms 2007, 488), in which sharing, deference to the will of the community, universal kin classification, primordial possession of the sacrosanct land, and harmonious natural equality were prominent – though there are obvious dangers in using such a scale of generalisation. Indeed, Julian Thomas (2007a, 431) has suggested that:

> Most hunter-gatherers consider that the landscape embodies vital forces and energies, which flow through patterns of reciprocity that link humans, animals, supernatural beings and places. Rather than a hostile environment, the landscape is one that provides for humans, within which animals are a kind of person who give up their flesh and energy, provided that they are treated with respect.

But such potential differences might be a more serious objection to the hypothesis of acculturation on its own than the perceived lack of contact with the continent. What overcomes the strength of this attitude in the adoption of, say, domesticated cattle?

Another difficulty from the perspective now of better timings is the claim for rapid initial change followed by gradual development (J. Thomas 2008). But could the acculturation hypothesis be adjusted to the different chronology of change which we now propose? In this view, things would begin in south-east England simply because that was the area closest to the continent. A process of substitution would ensue, with cattle favoured over deer, for example, and the novelty of cereals over traditional wild plants (J. Thomas 2004a; 2008, 67). Patterns of residence could have remained fluid and complex, with novel house structures embedded in seasonal, annual and lifetime cycles of movement through the landscape. Material culture changes, particularly the adoption of Carinated Bowl pottery and leaf arrowheads, would represent a 'new material language', 'a new 'technology of meaning'…clearly connected with memory, in that they brought clusters of associations and connotations to bear on social situations' (J. Thomas 1998, 154). Pottery would be to do primarily with the production, serving and storage of food (J. Thomas 1998, 154), though we could add the claim that carinated vessels do not work well for cooking (Starnini 2008). Thomas has further argued (1998, 154–5) that there is 'no indication that a single fixed or unified

code of meaning underlay this repertoire, or that any one artefact had a single cultural signification stamped upon it', preferring a sense of meanings produced in 'rather localized and contingent ways' (J. Thomas 1998, 155). This last point is problematic. The pure acculturation hypothesis might work best if it were argued that the adoption of new material forms such as Carinated Bowl pottery and leaf arrowheads stood for relation to a wider sense of belonging, a new set of connections, reformulated as the wider world had changed. It therefore seems rather contradictory to insist to such a degree on 'localized and contingent' contexts, and pit depositions from the south of England to the north-east of Scotland, for example, seem to have much more in common than otherwise. Nonetheless, the pure acculturation hypothesis might proceed with a kind of rolling spread of new practice, accelerating according to the timetable proposed by this project from the 39th century cal BC. But in this case, would we not see more local divergence in the things and practices adopted?

Given how much remains to be understood, not only through further and better dating but also by more isotopic analysis, especially for provenance studies, and by genetic investigations, it is unwise to be dogmatic. We have not excluded acculturation from our preferred interpretations, but it now seems special pleading to rely on acculturation entirely. In some senses, the actual 'whodunnit' (Halstead 1996, 299) of the Mesolithic-Neolithic transition in Britain and Ireland may be less important than the sense of the scale and tempo of subsequent changes. Sheridan's various strands of migration do not cover this next stage, and Thomas has relied on a notion of gradual change. So we go on now to reflect on the implications of our proposed timetable for better understanding of what came between the Mesolithic-Neolithic transitions and the emergence of causewayed enclosures in southern Britain in the late 38th century cal BC. Neolithic things and practices having been got ashore, so to speak, and been distributed across Britain and Ireland, we will focus especially on three themes: settlement and subsistence, early monument building and use, and artefacts.

15.3 Land and living: faultlines and patterns

The categories of evidence for examining settlement and subsistence in the early Neolithic of Britain and Ireland are well known: houses and other timber structures; pits and various spreads and concentrations of occupation material; faunal and plant assemblages; suites of environmental data; more recently isotopic analyses; and so on (e.g. Darvill 1996c; Brophy 2007; Garrow *et al.* 2005; Smyth 2006; Schulting 2008). Probably most commentators would agree with the view of Tim Ingold (2000, chapter 8) that what is important in this situation is not tracking the descent of new practices but evaluating the style in which life was now lived: 'positions in the land are no more laid out in advance for persons to occupy, than are persons specified prior to taking them up. Rather, to inhabit the land is to draw it to a particular focus, and in so doing to *constitute* a place' (Ingold 2000, 149). This appears to have been accepted by supporters of both acculturation, prominently (e.g. J. Thomas 2007a, 430–5; 2008, 81), and colonisation, subtly (e.g. Warren 2004, 91, explicitly following Ingold). That said, there are familiar differences of opinion on specific features: between those who tend to see houses and other timber structures as the permanent residences of sedentary people and those who interpret the same features as the monumental constructions of people still in the process of transition, seeking to create places of assembly and new foci of emergent identity; between those who see pits as potentially the enduring residue of prolonged tenure of place and those who interpret them as marking the comings and goings of a population recurrently and to varying degrees on the move; and between those who see the presence of mixed farmers from the outset and those who claim much more gradual change.

These interpretive faultlines are no longer, by and large, absolute. Thus, as selected examples, Alison Sheridan (2010) has interpreted the large timber houses of lowland eastern Scotland as 'the communal residences of the first generation or two of settlers, built to offer security while their communities became established', constituting 'powerful statements of identity and presence in the landscape', and implying a 'significant degree of sedentism'; interestingly, however, she explicitly allows that other flimsier structures could suggest transhumance, with part of the community living in one place over the course of a year. For Kenny Brophy (2007, 89–90), the same large timber structures could better be seen as 'big houses', neither purely domestic nor isolated ritual structures, but central both physically and conceptually, with some but unproven possibilities of more temporary occupations round about them. Duncan Garrow (2010) has discussed the consequences of seeing pits and the depositions they contained, for example at Kilverstone in Norfolk, as the surviving, visible residues of much more permanent residence than often allowed, whereas Joshua Pollard has talked in terms of 'little sense of such rigid long-term commitment to place *through settlement*', suggesting timescales of perhaps only a few years, and periodic aggregations, often on a small scale, rather than 'long-term settlement' (1999c, 82, 85–8). In contrast to those who have argued for gradual, small-scale and perhaps largely symbolic adoption of cereal cultivation in the early Neolithic (e.g. Fairbairn 1999a), Amy Bogaard and Glynis Jones (2007) have found, on the basis of quantified analysis of both cereal and associated weed remains, no difference in the likely scale of cultivation between the LBK and the early Neolithic in Britain. And debate still continues on the implications of isotopic dietary analysis. Much of this argument has focused on the claimed shift from marine to terrestrial signatures between late Mesolithic and early Neolithic (more recently Milner *et al*. 2004; Richards and Schulting 2006; J. Thomas 2007a; Schulting 2008), but it is helpful to remember that Michael Richards, who has been prominent among those arguing for rapidly introduced dietary shift at the start of the Neolithic, has allowed some diversity of diet, proposed patterned variation between the

mortuary populations of long barrows and causewayed enclosures respectively (M. Richards 2000), and suggested a possibly reduced role for plant products in general (M. Richards 2004, 89). For Ireland, Gabriel Cooney (2007a, 557) has allowed a 'variety of subsistence approaches'.

What has not been prominent in these varying debates is the question of timescales. This is not to claim that these are absent altogether, as seen above in the interpretations of both houses and diet. But there has been a general tendency, shared by most shades of opinion, to present a static sense of the first centuries of Neolithic in Britain and Ireland. One recent, rare exception explicitly cites and explores the period 3850–3650 cal BC in Dorset (Harris 2009). This section therefore has two aims: to draw attention to possible chronological patterns, trying to think above all of the context in which and from which causewayed enclosures emerged at the end of the 38th century cal BC, and in the light of possible trends, to offer some suggestions about the scale of activity in the landscape and the nature of production. Given the range of other changes seen as accelerating from the 38th into the 37th century cal BC (Figs 14.143 and 14.182), what does the evidence for land and living offer our understanding of the wider context? We will propose that it is so far difficult to find the same sense of continuing change in the domain of settlement as seen in other spheres, once Neolithic things and practices had been adopted, and this is ultimately very important in characterising the nature of the social dynamic in these first centuries. To some extent therefore we echo the emphasis by Julian Thomas (2008) on a contrast between the relatively rapid adoption of Neolithic ways and subsequent slower development. Whether this is the same in matters of production is less clear, however, and there may be some important hints of changes.

The models presented in Chapter 14 strongly suggest that most rectangular timber structures belonged to early stages of their regional sequences and were of comparatively short duration (Fig. 14.179). Neither timings nor durations were identical. Thus the structure at White Horse Stone began significantly earlier than the lowland Scottish halls, and those in turn began to be used earlier than the rectangular houses in Ireland, which flourished from the later 38th into the 37th century cal BC (Fig. 14.180). Gabriel Cooney (2007a, 557) has cautioned against seeing those 'just in terms of a complementary distribution with enclosures', though the parallel timings are certainly now very striking. Though the structure at White Horse Stone may have endured for several hundreds of years (Chapter 7.6), currently this appears exceptional as the dating evidence as a whole suggests relatively brief durations, impressively so in Ireland (Figs 12.22–8, 14.180). What we do not appear to be seeing is the persistence, by and large, of the practice of building rectangular timber structures, both large and small, right through the first centuries of the early Neolithic. Much of the effort involved in their construction may have been concentrated in the first generations of new styles of inhabitation of the land – land taking perhaps in some areas, or enhancement of existing practice in others.

The clues to changes through time in how people lived on the land are frustratingly scattered. On present evidence, the scale of things going on in the landscape was probably quite small in the period before the late 38th century cal BC. Even the 20m-long timber halls could have been put up by quite small workforces, or short-term aggregations if more hands were required. The setting out of the Sweet Track could also have been accomplished by a small number of people (Coles and Orme 1984a; 1984b). Generalising from the evidence presented in more detail in the regional chapters, there appear to be no large occupations before the late 38th century cal BC. Examples with reasonably secure dating from southern Britain include the structures at White Horse Stone and Yarnton, probably that at Penhale Round, the deposits in Area 6 at Eton, and the middens at both Ascott-under-Wychwood and Hazleton. Generalising in even more risky fashion, there is no compelling reason, as seemingly supported in recent, thorough regional reviews (e.g. Cotton and Field 2004; Hey and Barclay 2007; Lawson 2007), to see any great packing or density of occupation in the landscape, even at a local scale.

It is possible that occupation sites become more visible, and in some instances larger, over a longer timescale, probably from the 37th century cal BC onwards. It is striking in eastern England, for example, how the majority of the various eastern English pit sites discussed in Chapter 6 are associated with Mildenhall Ware, and with dates so far, as in limited fashion for Kilverstone, probably from the end of the 38th century cal BC onwards (Fig. 14.93: *start Decorated SE*). The Stumble and Runnymede may follow the same pattern, and in the upper Thames, the pit sites of Benson and South Stoke and the continuing use of Yarnton. It is not easy neatly to divide all the evidence in this way. Tregarrick in the south-west is a case in point, being probably early in the regional sequence but not certainly earlier than the enclosures of the south-west (Fig. 10.30). Perhaps the evidence so far is simply too scattered, but the issue of scale remains important. With the exceptions in East Anglia of pit sites like Kilverstone, Hurst Fen, Spong Hill, East Rudham, Eaton Heath and Broome Heath, there are still no convincingly large sites, and as far as those are concerned, the case for repeated, small-scale occupations – or even very short-term, social aggregations – is a strong one, spelled out particularly for Kilverstone (Garrow *et al.* 2005). There are some places in the landscape where significant concentrations of early Neolithic lithics were deposited, as at the possibly task-specific site of Honey Hill, Ramsey, Cambridgeshire (Edmonds *et al.* 1999). By and large, however, surface lithics of the period tend to be out-numbered, even swamped, by massive spreads of later material, as in the areas of Stonehenge (J. Richards 1990, 265–6, 271) and Avebury (Whittle *et al.* 2000, 148–51), and are often more circumscribed, as in the Maiden Castle area (R. Smith *et al.* 1997, 295–8).

So as a generalisation, we could propose that the appearance of causewayed and related enclosures in southern Britain does not correlate with any obvious increase in the numbers, size or density of dated occupation

sites. As a working hypothesis, therefore, we could also propose that the social dynamic of change did not reside principally in the styles of residence on the land. But what of other aspects of inhabitation and tenure?

We have included cereals and domesticated animals among our criteria for the presence of Neolithic things and practices, but there is still much that we do not know. There have been long-running and still unresolved debates about the overall range and balance of subsistence resources used in the early Neolithic. One view has been that despite rapid initial changes, a mix of wild and domesticated resources was still in use for considerable periods of time, with cattle pre-eminent, reduced consumption of marine resources (if not some kind of taboo on them), and some cereal cultivation (J. Thomas 2008, 70–4); 'Early Neolithic diets will have been diverse, with particular persons, kin groups or communities having access to varied combinations of domesticated and wild resources according to location, time of year, social status and positions in networks of exchange and alliance' (J. Thomas 2008, 72).

A more general survey of early Neolithic 'foodways' (Schulting 2008) has noted plenty of hazelnuts, substantial amounts of charred grain, including emmer, einkorn, barley and bread wheat, and among the animals, numerous cattle alongside fewer sheep/goats and pigs, with wild game scarcer; even in the Coneybury Anomaly, where game is present, cattle provided far more meat than roe deer. In this view, at least some of the community would have been restricted in their mobility by the demands of cereal cultivation, and to some extent pig keeping; some animal-related transhumance may be implied in northern England and Scotland, and periodic concentrations of cattle are evidenced by the dung beetles and high phosphate levels at Etton (see Chapter 6) (Schulting 2008, 97). The Céide Fields in western Ireland (see Chapter 12) 'provide some sense of the potential scale of animal keeping', and isotopic analysis on probably slightly later material from the Orkneys may suggest close control of sheep, in the evidence for seaweed foddering of pregnant ewes in the run-up to lambing (Schulting 2008, 98; Balasse *et al.* 2005). Cattle could have been used for ploughing, other forms of traction, and as pack animals, and could have been the object of raiding (Schulting 2008, 99, 111). Lipid analysis has shown the widespread presence of dairy products (Copley *et al.* 2005; Copley and Evershed 2007).

Slight differences in isotopic data and caries rates from a series of sites in southern Britain allow 'local variations on a theme' (Schulting 2008, 96), to that extent agreeing with the otherwise rather different interpretation of Julian Thomas. Isotopic analysis has indicated a 'comprehensive shift' away from marine resources, at least in coastal areas (Schulting 2008, 95; cf. Schulting and Richards 2002a; 2002b; M. Richards *et al*. 2003), though questions of representativeness have been raised (Milner *et al.* 2004; cf. Richards and Schulting 2006). Perhaps what is minimally indicated is the end of the specialisation seen in some late Mesolithic diets (R. Hedges 2004). Isotopic analysis has also indicated variability between sites in southern Britain, such as the people buried in the long barrows at Parc le Breos Cwm, Hazleton, West Kennet, Hambledon Hill and Ascott-under-Wychwood (M. Richards 2000; R. Hedges *et al.* 2007b; 2008). The most notable variation in nitrogen isotope values has been seen at Hambledon Hill causewayed enclosure (M. Richards 2000; 2008), consistent with its likely role as a place of assembly of people potentially from far and wide, though the values reported from other enclosures in Chapter 13, admittedly on the basis of rather small samples, may hint at a more uniform picture. These values in general indicate a potentially high portion – at least 60% and sometimes as much as 80% – of the human dietary protein coming from animals, as meat and/or milk, assuming little or no intake of marine or freshwater fish (Hedges and Reynard 2007); this could translate into 'a meat intake of approximately 300g per person per day, or a milk intake of abut 3 litres, or a combination' (Hedges and Reynard 2007, 1248). However, there is much still to be understood about the relationships between faunal and human values in the trophic chain, and slight alterations in working assumptions serve to markedly reduce the contribution of human dietary protein from animals (potentially to 35–40%; Hedges and Reynard 2007, 1245–7). Even with the assumptions normally made, the contribution of cereal protein may be underrepresented, and 'a diet corresponding to the estimated high trophic level (75% of total protein from animal protein) may in fact be equivalent to 33% by weight of meat and 65% by weight of grain' (R. Hedges *et al.* 2008, 122). Glynis Jones has correspondingly pointed out that cereals may be consistently under-represented among charred plant remains (G. Jones 2000; Jones and Legge 2008).

Further isotopic work in the course this project (Julie Hamilton and Robert Hedges, Chapter 13) emphasises the extent to which variations in human stable isotope values are a product of variations in those of the animals which they ate (Fig. 13.1). In a small sample of sites, Windmill Hill stands out by the greater depletion of both animals and humans in both ^{13}C and ^{15}N, suggesting that, whatever the catchment of the enclosure, it was similar for bipeds and quadrupeds.

We can note in passing that few surveys of subsistence evidence at present incorporate the pollen story. This is mainly because there is a geographical disjunction between the varying sets of evidence: with enclosures and many of the relevant barrow sites in the south, in areas poor in pollen, and sites of pollen analysis in deeply stratified sequences often in the north and west, in areas of poorer bone preservation. The generalisation does not entirely hold true, as we have noted relevant pollen analyses on the edge of the Fens in East Anglia, the Thames estuary, the upper Thames valley and the Somerset Levels, but these are exceptions to a wider pattern of difference. Beyond this, there is a challenge now for palynologists to model *their* chronological frameworks more precisely (Blaauw and Christen 2005; Bronk Ramsey 2008), so that this evidence can be meaningfully related to our emerging archaeological narratives.

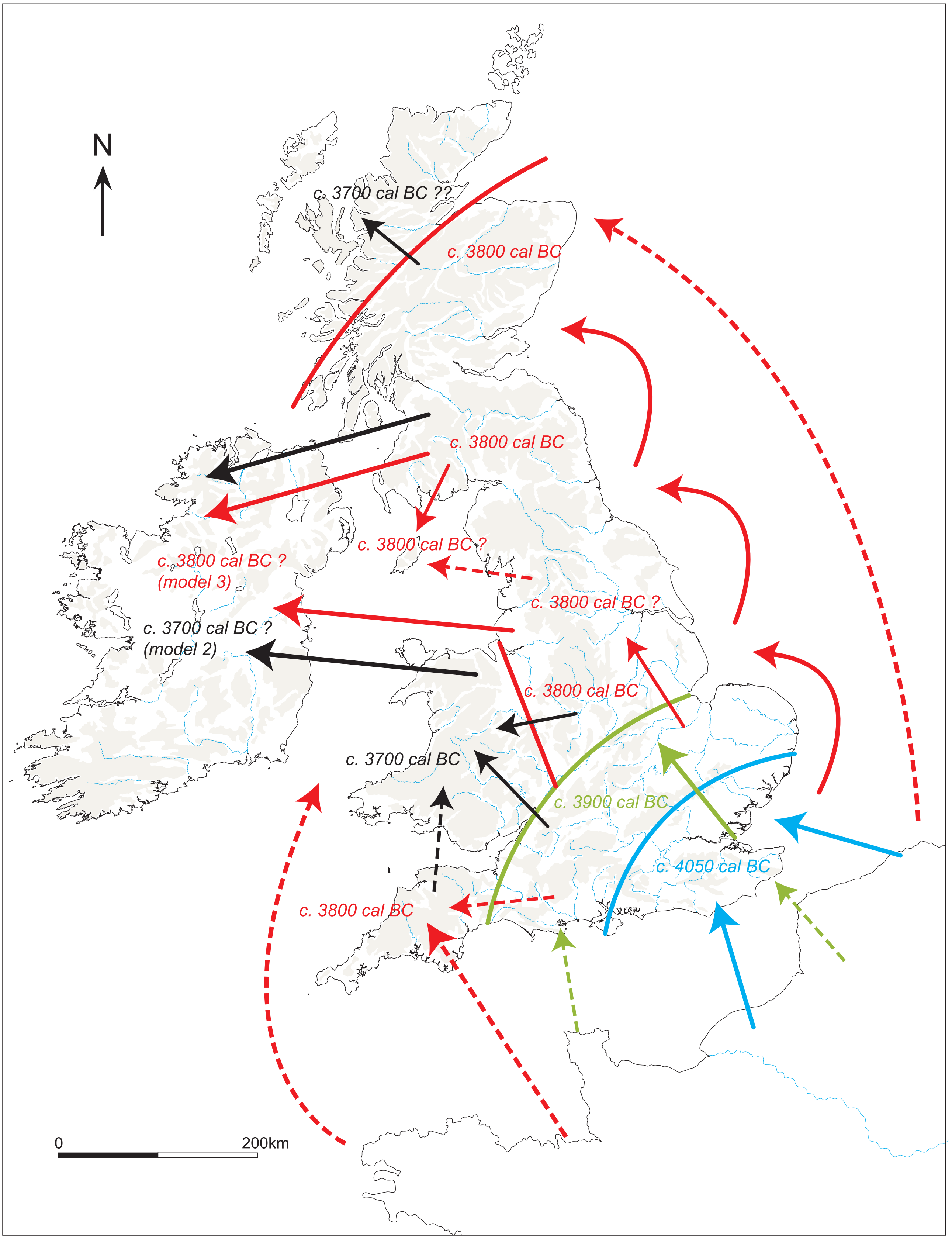


Fig. 15.8. Interpretive map of suggested dates, source areas and directions in the spread of Neolithic things and practices across Britain and Ireland. The colours denote contacts at different dates. Compare Fig. 14.176.

Fig. 15.9. House C at Monanny, Co. Monaghan, Ireland, under excavation, looking south-west. Photo: Irish Archaeological Consultancy Ltd.

What changes through time can we now detect? This is far from straightforward. The isotopic data from Ascott-under-Wychwood and Hazleton (R. Hedges *et al.* 2007b; 2008) come from individuals who probably lived during the 38th and 37th centuries cal BC (Bayliss *et al.* 2007c; Meadows *et al*. 2007). The values from the two sites, however, do not appear markedly different from the overall pattern already noted. Isotope values from Coldrum have yet to be published, but probably also conform to this pattern (Wysocki *et al.* in prep.). The occupation and midden underlying the long barrow at Ascott-under-Wychwood show the presence of domesticated animals in the 40th or 39th centuries cal BC, along with some wild game, including aurochs, red and roe deer and boar; among the domesticates. Although the sample size was small, cattle were roughly twice as numerous as pig, and sheep/goats were scarce, more or less matching the numbers of game (Mulville and Grigson 2007). Lipid analysis showed the presence of dairy fats, as well as products from ruminants and porcine animals (Copley and Evershed 2007). This single site appears to show an early establishment of patterns repeated in subsequent centuries, but given that the accumulation of the pre-barrow occupation and midden was not a single event (Bayliss *et al.* 2007c), it is hard yet again to get at the scale of things. Cereal cultivation could not definitely be shown here (without flotation), though there are cereals in the pre-cairn activity at Hazleton (Straker 1990), and they are attested at White Horse Stone (see Chapter 7.6).

Two sites which are potentially early, Coneybury Anomaly and Rowden (see Chapter 4.3–4), do hint at the scale of pre-enclosure consumption events. The contents of the Coneybury pit (Maltby 1990) have often been discussed for the presence of game, including roe and red deer, beaver and trout, but even here the much greater weight of beef compared with venison has recently been stressed (Legge 2008, 555). Some eight cattle appear to be represented (Maltby 1990), six in the subadult/young adult age range found predominantly at Hambledon Hill (Legge 2008, 555). Although it has been claimed that ‘the bones from the Coneybury pit are evidently related to a brief and sumptuous slaughter event’ (Legge 2008, 555), the temporality of deposition, as well as its timing, are not clear, since there was uneven body part representation and some of the pottery sherds appear weathered (Cleal 1990a). At Rowden, where there were also cereal remains, the most numerous bones came from pigs rather than cattle (Maltby 1991; Harris 2009, 116–17). Several animals may

be represented, but it is possible that these accumulated over a period of time before deposition in a single event into the pit (Harris 2009, 117).

Many of the sites with isotopic data noted above belong to the 37th century cal BC or later. The settlement at Runnymede in the middle Thames is not demonstrably earlier (see Chapter 8.3). Here, cattle, predominantly young animals, were dominant over pigs and sheep by weight, game were scarce, and there were signs (from fragmentation, butchery patterns and burning) that cattle bone had been treated differently to that of smaller animals, suggesting their use principally for feasting rather than regular meals (Serjeantson 2006).

By definition now, evidence from causewayed enclosures belongs only from the late 38th century cal BC onwards. Anthony Legge (2008) has recently presented the animal bone evidence for Hambledon Hill, giving a picture of dominance by cattle. There was probably a non-resident cattle herd, from which mainly female cattle were culled, mostly subadult or young adult. Individual episodes of consumption, almost certainly involving animals taken alive to the site, can be identified in various contexts through many of the site phases, possibly involving some 100 beasts overall in the central area, and some 35–40 in the Stepleton complex, but probably only one or two animals in any one context, at least where most visible in the slots of the uppermost ditch fills of the central area. This presentation concentrates on consumption, played out in a series of events which periodically provided extravagant amounts of beef. It emphasises much less the nature of the live cattle herd, which might have in fact been constituted by any number of smaller herds at varying ranges from the site, and in which it can be inferred (*contra* Legge 2008, 544) that the possession of bulls was particularly important. So the general impression is of considerable concentrations of people in periodic assemblies (Legge 2008, 556), but the scale of cattle keeping out in the landscape remains much harder to quantify, given the substantial site timescale involved (see Chapter 4.1). Other patterns are also hard to read in terms of scale and intensity. Pigs were the second most numerous animals, slightly more frequent in the Stepleton enclosure, reinforcing other signs of its slightly different character (Mercer and Healy 2008, 326–37). Young sheep may have been culled in spring and autumn, though the sample was small (Legge 2008, 554), and sheep were generally culled across a wide rather than selective age range. Cereals may have arrived at the site in a semi-processed state, again implying its special character and periodic use (Legge 2008, 555; Jones and Legge 2008). The quantities were very substantial, suggesting a significant role for cultivated plant foods (Jones and Legge 2008, 476). Again, however, it is hard to quantify the scale of local or regional cultivation. If cleaned grain was being brought into the complex, its range is unknown. An exception to the import of cleaned grain is a massive emmer spikelet deposit from the Stepleton spur, which appears comparable to that from one of the Lismore Fields houses (Jones and Legge 2008, 474).

Further afield, there were cereal deposits at Balbridie, probably dating from the 38th and 37th centuries cal BC (Fig. 14.174). Other cereal finds of this sort of date from Garthdee Road and Forest Road, Kintore (Table 14.14) may suggest a well established practice of cereal cultivation, but again give little clue on their own to scale. Irish data (Monk 2000) are not demonstrably any earlier, finds from rectangular houses probably belonging to the late 38th into the later 37th centuries cal BC; similar finds from the interior of Magheraboy, along with sheep bones, probably date to no earlier than the 38th century cal BC (Table 12.2).

The potential symbolic significance of cattle can be traced back to at least the 38th century cal BC, in the form of the cattle skull laid on the old ground surface below the Ascott-under-Wychwood long barrow at a time judged to be that of construction (Benson and Whittle 2007, 225; Bayliss *et al.* 2007c). But just how large cattle and other herds were even in enclosure times is actually very hard to estimate. The recurrent emphasis on consumption of cattle at enclosures and other sites is certainly suggestive of a changing scale, though much of the impetus for this kind of social interaction could have resided in dealings with live animals: beasts and herds to admire and possess, to multiply and covet, and to acquire not only by patient breeding but also perhaps by raiding and theft. But what we need now for much greater clarity is a series of pre-enclosure sites, ideally dated to the 38th century cal BC and earlier. Did cattle herds take off in numbers as the first enclosures came to be constructed, or were they already there, part of the existing conditions in which the enclosure idea so dramatically flourished? Were they a major staple of the first centuries, or did they become more important along with the surge of other changes in the 38th century cal BC?

15.4 Building the world: monument sequences

Clearer patterns are beginning to emerge for the development of monuments and artefacts. With the varied constructions which we call monuments, we have suggested three important stages. First, there appears to be an initial phase in which monuments were scarce (sometimes without standardised forms), or absent; secondly, it appears that what can be seen as more typical long barrow and long cairn constructions (Fig. 15.10) became more common from around and after 3800 cal BC; and thirdly, this was followed around a century or so later – perhaps four generations – by the beginnings of the southern British enclosure tradition. The sequences in Ireland and Scotland need not be the same, and the challenges thrown up by Magheraboy have been extensively discussed. But the models which suggest start dates for the Neolithic in both Ireland and Scotland around 3800 cal BC include dates for constructions broadly allied to the long barrow and long cairn tradition, and are generally consistent with the trend suggested for southern Britain.

Our models do not agree with all other schemes in the

literature. We see no grounds to support the existence of very early passage tombs in the west of Ireland or indeed the west of Scotland (e.g. Fig. 12.50, and see above Chapter 15.2), and similarly, rotundae and oval barrows in the Cotswolds and elsewhere in southern Britain are not necessarily early types (e.g. Figs 9.26 and 11.14). There is also little – and so far ambiguous – evidence for a very early date for portal tombs in Ireland and western Britain (Figs 12.31 and 11.10), and we still have only a hazy notion of when court tombs were first built (Figs 12.32–4), beyond their general material associations and the stratigraphic relationship between rectangular timber house and court tomb at Ballyglass. But that still leaves considerable diversity in general, including such features as the timber or non-megalithic monuments of Ireland (e.g. Sheridan 2006a). Above all, we have now some better idea of the tempo of change, and that potentially brings new insights into the significance of pre-enclosure developments, and in turn into the setting in which enclosures themselves emerged.

Candidates for early constructions include Coldrum and the banana barrow at Crickley Hill; Burn Ground, Broadsands and the Post and Sweet Tracks are also candidates for relatively early dates, but appear much closer to *c.* 3800 cal BC. We have argued that the earliest human burials at Coldrum, probably from the 40th century cal BC onwards, date the construction of the substantial stone chamber in which they are deposited (Chapter 7.6). There is no primary association with human remains for the Crickley banana barrow, and its dating is uncertain (Fig. 9.8), though it definitely precedes the first enclosure there. The flint mines of Sussex, probably from at least the 40th century cal BC onwards (Figs 5.33–5) are another early kind of construction. If these enterprises offer different kinds of construction and assembly before *c.* 3800 cal BC, what is striking, apart from their apparent scarcity, is their diversity. The early Neolithic communities which we have sought to characterise began to undertake building and construction on a scale evidently neither practised nor perhaps imagined in the late Mesolithic.

That takes us back to the character of the beginning of the Neolithic in southern Britain. From the diversity suggested, it is hard to read off any particular continental cultural imprint, further reinforcing the suggestion made earlier in this chapter that both incomers and indigenous people were closely involved in the spread and development of Neolithic things and practices from early on in the process. The possible continental precedents are very scattered. The stone box at Coldrum is not easily paralleled, and the earlier literature on the site in fact sought wide antecedents, including in Scandinavia, north Germany and the Low Countries (Daniel 1950; Piggott 1935; J.H. Evans 1950; Jessup 1970). Chronologically, that now seems less probable, given the suggested date for the appearance of stone dolmens in southern Scandinavia *c.* 3600 cal BC, *after* an initial phase of earthen long barrows (Ebbesen 2007; Midgley 2008; Müller 1998), and the even later probable date for the appearance of Dutch hunebeds (Louwe Kooijmans *et al.* 2005). The other allowable area would then be Normandy or Brittany. The form of Broadsands is so simple that it is not easy either to categorise or to find specific comparanda for it. The long mound idea could go back to a variety of sources, from the Passy monuments of the Cerny culture in the Paris Basin, probably of the mid-fifth millennium cal BC (Demoule 2007a), to early TRB constructions in central Poland at a possibly similar or slightly later date (Midgley 2005; 2008). As already noted above, some framed and enclosed single graves are known in northern France, with early Michelsberg material associations – potentially late fifth millennium cal BC in date (Demoule 2007b). Likewise, long cairns in Normandy such as Vierville have now been dated to the late fifth millennium cal BC (Verron 2000; Sheridan 2010), and there are other, perhaps slightly earlier, elongated constructions in that area, as at Rots on the plain of Caen (Kinnes 1999). Mines can, however, be found in northern France and Belgium (Chapter 5.9).

Diversity in the first generations of the Neolithic in southern Britain is underlined by the simple grave at Yabsley Street, Blackwall (S. Coles *et al.* 2008; and see Chapter 7.3). Then perhaps by around 3800 cal BC, more established traditions of building cairns and barrows seem to have appeared. The sample of well dated constructions is still very small. To the five southern long barrows now formally modelled (Bayliss and Whittle 2007) can be added the Hambledon Hill long barrow (Mercer and Healy 2008; and see Chapter 4.1), the long barrow, turf mound and avenue at Raunds (Harding and Healy 2007; and see Chapter 6.3.2), and the Haddenham long barrow (Evans and Hodder 2006; and see Chapter 6.2.3). Burn Ground in the Cotswolds (Smith and Brickley 2006; and see Chapter 9.4) may belong towards the beginning of this suggested phase. Other less well dated southern British sites have been reviewed recently by Whittle *et al.* (2007a). The difficulties with Irish monument sequences have been stressed in Chapter 12, but some early Scottish constructions have good series of dates on short-life material, and have been modelled in Chapter 14.7 (Figs 14.150–3 and 14.154–7).

As this better dating evidence gradually accumulates, and in the effort for better understanding of the context in which enclosures were to emerge, older debates on the associations, meanings and social significance of these monumental traditions must be revisited. Taken on their own, the early monuments associated with human burials have been treated in oscillating ways. Already by 1950 (for other reviews see Darvill 2004a; Smith and Brickley 2009), Glyn Daniel was at pains to set aside an older concept to explain collective deposits, that of sacrifices to accompany dead chieftains to the beyond (Daniel 1950). In the 1970s, Colin Renfrew grouped southern long barrows and causewayed enclosures together to form a pre-chiefdom phase of social development, the emphasis here being on the relatively modest labour input required to construct individual barrows, and indeed individual enclosures (Renfrew 1973b). He saw barrows as 'territorial markers' (Renfrew 1976), and writing of megalithic tombs on the

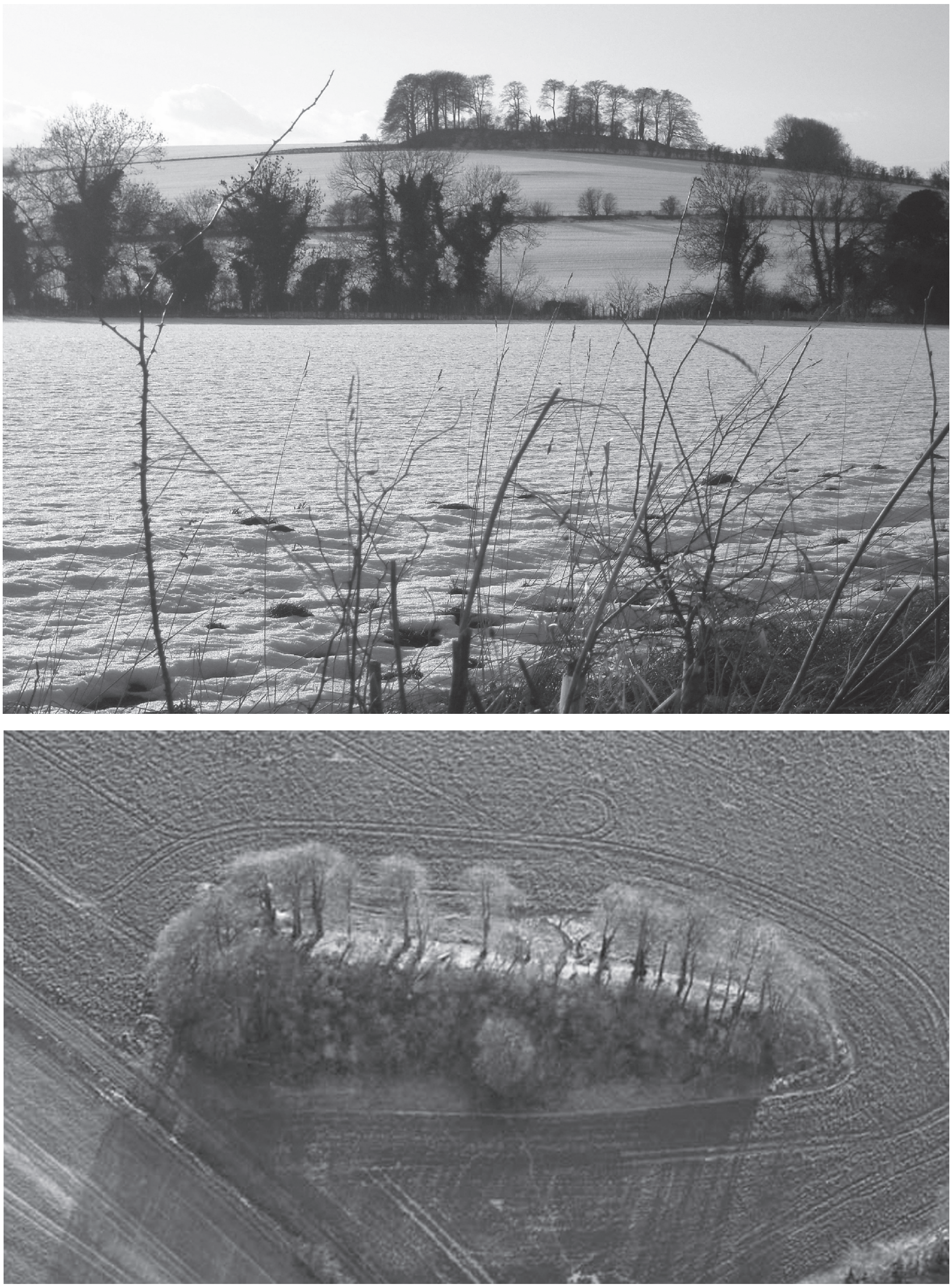


Fig. 15.10. East Kennet long barrow, Marlborough Downs, north Wiltshire. Photos: (top) David Field; (lower) ©English Heritage. NMR.

Orkneys, he characterised them as the work of 'segmentary societies' principally on the basis of their dispersal across the landscape, such that each could be seen as at the centre of its own territory (Renfrew 1979). By the 1980s, ancestors came to the fore, first as legitimators of claims to land and resources (e.g. R. Bradley 1984a, 15–20), and then more generally as a kind of spiritual underpinning of the Neolithic way of life (e.g. Edmonds 1999). An ideological twist was offered in the view that overtly collective and egalitarian rites of disposal could have in fact masked much less equal power relations (Shanks and Tilley 1982). As well as ongoing technical discussions about the processes of formation and transformation involved in collective deposits, recent and current opinion reflects a range of possibilities, from commemoration of forebears in general (Barrett 1988) to dynastic arrangements in a competitive and sometimes violent social setting (Mercer 2006a; 2006b). Richard Bradley (2007, 50–9) has been careful to stress the extent of possible variation, including between Britain and Ireland. Access to interiors was

perhaps restricted to a 'smaller group' than the totality of daily passers-by or of those who attended ceremonies at a site, though the presence of abundant remains allows the notion that 'the monuments stood for a wider community' (R. Bradley 2007, 52, 54); local variation 'may have been influenced by the status of particular individuals' (R. Bradley 2007, 55).

Although much attention has been given to sequences of development at individual sites (e.g. Kinnes 1992; Evans and Hodder 2006; R. Bradley 2007, 55–7), comparatively little detailed interpretation has been offered of change through time, other than at the scale of broad comparisons between earlier and later phases of the Neolithic. This is in contrast to the situation elsewhere, for example in Denmark, where it is possible to see a succession from early long barrows normally with just one or two people inhumed under or in them, to dolmens, from *c.* 3600 cal BC, with larger deposits in both closed and open chambers, and then to the numerous passage graves, perhaps in a concentrated horizon in the later fourth millennium cal BC, with their abundant and often compartmentalised human remains (Ebbesen 2007). Two exceptions, both dealing with the Orkneys, should be noted. Johannes Müller (1990) modelled the increasing labour force for monument construction, the centralisation processes, the opening of external networks, the opening of the landscape and a collapse at the end of the Neolithic. Chris Scarre (2007b, 53–5) has likewise proposed that increasing labour for monument construction reflects a progressive centralisation of political power across four phases of change through the Neolithic sequence as a whole; the precise chronology, however, is not specified.

A more focused approach came out of the pilot study on the Bayesian modelling of the chronology of southern long barrows (Bayliss and Whittle 2007). As well as indicating more precise timings and durations for individual monuments, this found little support for any notion of curated or ancestral bone; no material older than one or two generations seems to have been involved, and that potentially only at Hazleton and Fussell's Lodge (Meadows *et al*. 2007, 60; Wysocki *et al.* 2007, 81–2). The emphasis appears now to have been on the known and remembered dead, over spans of from one generation, as suggested for West Kennet (Bayliss *et al.* 2007b, fig. 6), to three to five, as at Ascott-under-Wychwood (Bayliss *et al.* 2007c, fig. 9). Given the initial indications of timing, Ascott-under-Wychwood in particular has been discussed in terms of a coming to terms with changing circumstances, especially the conceptual and psychological alterations in existence during the first two centuries of Neolithic practice, of small communities, turned in on themselves and principally conscious of their own identities, internal composition and categorisations (Whittle 2007b; cf. Whittle *et al.* 2007a). Perhaps this model too, which harks back to the egalitarian interpretive tradition in long barrow studies, now deserves to be challenged in the light of the wider emergent chronology.

If barrow construction became more frequent *c.* 3800 cal BC, that surely marks a significant shift. We do not know whether barrows and cairns came to be first built in substantial numbers with a great rush, as appears to be the case with enclosures a little later. But we should not then freeze the barrow phenomenon into a single frame. Judging simplistically from the sample of modelled southern long barrows, it could be that, whatever the precise rate at which the phenomenon took off, many of these constructions were being built already in the generations around 3800 cal BC – as probably indicated by Burn Ground, Ascott-under-Wychwood and Hazleton (Fig. 9.28). Importantly, they also continued to be developed and used in the 37th century cal BC, as the enclosure phenomenon rapidly got going – as variously indicated by Ascott-under-Wychwood, Hazleton and Fussell's Lodge. And there were major new constructions, as at West Kennet in the later 37th century cal BC, dating to the same time, whatever model for its interpretation is preferred (Wysocki *et al.* 2007), and as in the closing of the existing structures at Fussell's Lodge by the throwing up of the long barrow (Whittle *et al.* 2007a, fig. 6).

There could have been both difference and continuity between the barrow constructions of the pre-enclosure and enclosure horizons. Difference could rest in the details of architectural style and of the character of depositions. Thus the largest mound locally occurs at West Kennet, along with the spatial separation of chambers and passage, though Burn Ground appears to offer something very similar at an earlier date. West Kennet, however, also provides the greatest sense of categorisation of the dead, and Fussell's Lodge, if the third, preferred, model of its sequence is followed (Wysocki *et al.* 2007), may provide something intermediate between that and the collective deposits of Hazleton and Ascott-under-Wychwood, in the first half of the 37th century cal BC. In addition its outermost burials and latest deposits are one individual and another assemblage of parts of two individuals arranged to look like one individual, along with a cattle skull and a decorated pot. Continuity, however, can be sought in the generalities of these practices, from gathering up the remains – probably in many cases the corpses – of the freshly dead into purpose-built containers, to their marking and commemoration with substantial barrows and cairns. So practices may have altered subtly, and there may be significant difference between the accumulation of 21 people probably over three to five generations at Ascott-under-Wychwood and the deposition of over 40 people at West Kennet probably within one generation. But using and building barrows and cairns in southern Britain were not abandoned when enclosures started to be constructed, and so were evidently part and parcel of the same evolving worldview and social system. If so, a different perspective to that previously offered for Ascott-under-Wychwood may now be more appropriate. It is perhaps in the first two centuries or so of the Neolithic that people came to terms with changing circumstances, as putative incomers reacted to a new setting and new neighbours, and as indigenous people incorporated new ways of doing things. The pace

of change may have quickened towards 3800 cal BC, and it may make most sense now to turn again to those models with elements at least of emulation, tension and competition in them, to best come to terms with the whole accelerating sequence from the 38th into the 37th century cal BC.

In this view, long barrows and long cairns can become markers again, but not perhaps as literal territorial markers as in the original formulation of that idea, since the evidence reviewed above for settlement and subsistence does not suggest urgent need for space as such, and because there was much variation within southern Britain in the frequency with which such constructions were built. If there were pressures on land and resources, we might expect them in areas like the middle and lower Thames and parts of East Anglia, where in fact barrows are comparatively infrequent. Rather barrows and cairns could have marked places and plural pasts important to both the self-definition of small communities and to their wider identity in relation to others. Perhaps it is time to be literal, and to collapse some of the subtle distinctions drawn between overt display and covert intentions, and to emphasise again the small numbers involved, which reduce even further with up-to-date analysis (Wysocki and Whittle 2000; Smith and Brickley 2009, 87–8). We seem stuck with a modern notion of the 'wider community', which does not adequately catch the nature or composition of a social landscape with disparate, dispersed and perhaps fluid groups in it. Some of these constructions could have been built to look back to very old pasts, as often mooted in long barrow studies, but given the times and distances involved, it is at least as likely that it was more immediate connections with contemporary or recent continental practices that were being invoked, and the deposition of the newly dead also places things firmly in the present rather than in an ancient past. Mary Helms (1998, 6–10), writing of hierarchical chiefdom societies, has stressed the associations of aristocrats with ancestors, and their role as affinal outsiders and thereby as inherently superior living ancestors. The argument in this chapter is not for emergent chiefdoms as such in the 38th century cal BC, but the importance of cosmological primacy at the heart of politics in kin-based society (Helms 1998, 11; 2007) would be one way to link our observations of the emergence of long barrows and cairns. It became important, over and over again, to deposit successive corpses or other human remains, each occasion perhaps the opportunity for overt display, in structures that themselves could have evoked a variety of cosmological distances beyond the immediate setting, thus fusing present and past. The potential rate at which such structures were built and used from the 38th into the 37th century cal BC in parts of southern Britain seems not only to underline the importance of this new practice, quite unlike anything that had gone before in the insular setting, but also strongly to suggest its competitive character.

It is hard to say at this stage whether the same overall sequence of monument development was followed in Ireland. Richard Bradley (2007, 59–62) has sketched a scheme to explain major differences between England and Ireland, relating the main ways in which the dead were deposited (with the emphasis in Ireland on cremation) to the manner in which residence was lived (more houses in Ireland) and the way in which structures came to an end (house burning in Ireland). In the light of the short chronology proposed for the use of rectangular houses in Ireland, and the wider uncertainties about the specific periods in which court tombs and other related monuments were constructed, it is wise to be cautious about this scenario. In addition, it may not capture sufficient of the variation evident in Ireland, with inhumations in some portal tombs, in caves, and in monuments like Parknabinnia (see Chapter 12.3).

In lowland southern and eastern Scotland, there may have been further difference. Things came in a rush, as it were, as 'mortuary' enclosures and long barrows appear to have been a feature of the early Neolithic landscape, at the same time as timber halls (Fig. 14.175). There was therefore no demonstrable lag between the establishment of Neolithic practices and the appearance of 'monuments' (Fig. 14.179). It is hard to tell the numbers of people deposited in constructions like those at Eweford West, Pencraig Hill or Forest Road, Kintore, though they may have been low (MacGregor and McLellan 2007, 23, 41; Cook and Dunbar 2008, 49). A simplistic reading of the evidence could suggest relatively few such monuments in the lowland setting, despite recent advances in recovery and understanding. This might seem similar to the early situation noted above for Denmark. It is hard at this stage therefore to read the same possibilities for a competitive increase in constructions in lowland Scotland as in parts of southern Britain. We will simply have to wait for further work on highland and western monuments in Scotland to reveal their main chronological trends.

15.5 Artefacts

Although the scope of interpretation of material culture has vastly increased in recent years, sufficient to attract the criticism that the term 'materiality' has become far too abstract (Ingold 2007b), the earliest Neolithic material in southern Britain and Ireland has been comparatively little discussed in its own right. Major effort has gone into establishing the order of things on the one hand (e.g. Herne 1988; Cleal 2004), and seeking the genealogies of descent and relationship on the other. Both are important, and a sense of connections is as significant in material culture as with monuments. But perhaps too many of the properties and associations of this early material have been overlooked. Andrew Herne wrote briefly some time ago (1988, 26) of the Carinated Bowl as unique material symbol, which 'must have affected [sic] radical changes in the cultural categories and symbolic boundaries that are built around the consumption of edible food'. Others like Alfred Gell (1998) have written in general terms of the 'technology of enchantment', and the ways in which objects can act as citations in fields or networks of relationships (A. Jones 2007, 81). But how might this actually have

worked in the early Neolithic context? We concentrate here on pottery, leaf arrowheads and flaked, ground and polished stone and flint axes, though other aspects of flint working should also be kept in mind, to think about the circumstances of production, form, textures, and connotations of novelty and difference. Combined with the sequences modelled in this volume, this material can serve further to enhance the sense of dynamic change proposed here, both at the beginning of the Neolithic and especially from the 38th into the 37th century cal BC.

Pottery-making entailed a suite of unfamiliar skills, from the selection and preparation of clay and temper to the actual firing. The final stages of the process were transformations on a scale and of a nature not seen before in the insular setting. These could have been imbued with a level of mystique, even magic, similar to that attached to metalworking, another transformation by fire, in later periods. We know virtually nothing of the specific circumstances in which early pots were fired. Herne suggested (1988, 26) that potting could have been 'a carefully controlled procedure, one hedged around with formalized rules and practices, that both made the outcome symbolically safe and pragmatically successful'. The frequently high quality, in fabric, form and finish, of Carinated Bowls – at their best thin-walled, hard, and burnished – points to symbolic value.

New forms of arrowhead and axehead would, on the other hand, have been made by the application of familiar skills. But extra-functional qualities reached new levels (Fig. 15.11). The shallow, invasive flaking of many leaf arrowheads called for considerable skill and control and went beyond functional need, since many others were only marginally retouched (e.g. Middleton 1998, fig. 227) and an unknown number of early fourth millennium arrowheads may not have been retouched at all, on the evidence of an unretouched flake from beside the Sweet Track in the Somerset Levels, hafted in the same way as invasively flaked leaf arrowheads from nearby (J. Coles *et al.* 1973, 291). The elaborate finish of many leaf arrowheads could relate to their use in interpersonal conflict, with all its formal and informal rituals, from at least the 37th century cal BC (Fig. 14.36) and probably before. Whether or not this was the case, there was a change in archery itself. Single-piece arrowheads were rare in Britain before the start of the Neolithic, far more so than in north-west Europe. True *petit tranchet* arrowheads (in the sense of blade segments of symmetrical trapezoid outline with abrupt bilateral retouch) occasionally occur in late Mesolithic contexts (e.g. Holgate 1988b, 90) but are scarce overall; Stephen Green could list fewer than 300 from England and Wales against over 15,000 leaf arrowheads (1980, figs 31, 39; table VII.6). Furthermore, while there is a gradually increasing tally of Mesolithic bows and arrows from waterlogged contexts in Europe (e.g. Guilaine and Zammit 2005, 63–7), the few British examples were all made in the fourth millennium cal BC or later, on the evidence of radiocarbon dates, peat stratigraphy, arrowhead typology, or all three (Clark 1963; S. Green 1980, 170–83; Sheridan 1996). In this case absence of evidence is emphatically not evidence of absence, but it raises the possibility that archery may have become more frequent in Britain with the Neolithic.

Effort was also expended on the appearance and texture of axeheads. Not only did their form change, but far more time than invested in their original flaking was often devoted to grinding part or all of their surfaces, often beyond any improvement to the efficiency of the implement. Experiment suggests seven to nine hours of labour for an all-over-ground group VI axehead and up to three times as long for a flint one (Bradley and Edmonds 1993, 89; P. Harding 1987). While this had already been practised to some extent in Ireland and south Wales, its new frequency and ubiquity express a new belief that this was how the artefacts should be finished and how they should look and feel. As with arrowheads and other invasively retouched implements, 'the appearance of at least some of these objects may have at least as much to do with how they were perceived as how they were used' (Edmonds 1995, 45–6). An equally striking change in attitudes to axes is seen in the sinking of flint mines on the South Downs, probably from the 40th century cal BC (Chapter 5.9; Figs 14.129 and 5.33). This was the import not only of north-west European expertise but of a belief that it was worthwhile, even necessary, to win material for axeheads from below ground at considerable labour and risk. The powerful conceptual connotations and associations of mining and quarrying are explored by, among others, Barber *et al.* (1999, 61–7, 73), Topping (2004) and Edmonds (1995, 59–66). From the 39th century, too, visually distinctive flints from other, superficial sources were selected for axehead manufacture (Fig. 14.118).

All these artefacts may also have had other connotations of difference, linked to a sense of the distant and the exotic. As well as being associated with novel foodstuffs, pots could have been seen as coming from 'over there': for incomers and their direct descendants a visible and tangible link to areas of continental origin, and for indigenous people a symbol of novel affiliation with much wider social networks. It is clear that jadeitite axeheads were in circulation in Britain by around the end of the 39th century cal BC (Fig. 14.128), perhaps already with the status of old and valued heirlooms of continental descent (Pétrequin *et al.* 2008). The importance of the axe and the axehead is seen in Brittany in their representation on menhirs and in passage graves (Le Roux 1984).

These patterns of material novelty were not static. Ground stone axeheads from south-western sources came into use as Neolithic practices spread to the west, from at least the early 37th century cal BC (Fig. 14.124), an initial regional circulation expanding to an insular one after perhaps only a generation or two (Fig. 14.139). This formed part of a wider establishment of long-distance exchange networks, encompassing gabbroic pottery from the same area and axeheads from the north-west and other areas, which was established in the decades around 3700 cal BC (Fig. 14.138). Likewise, Decorated Bowl pottery was probably in use by the late 38th century cal BC (Fig. 14.92).

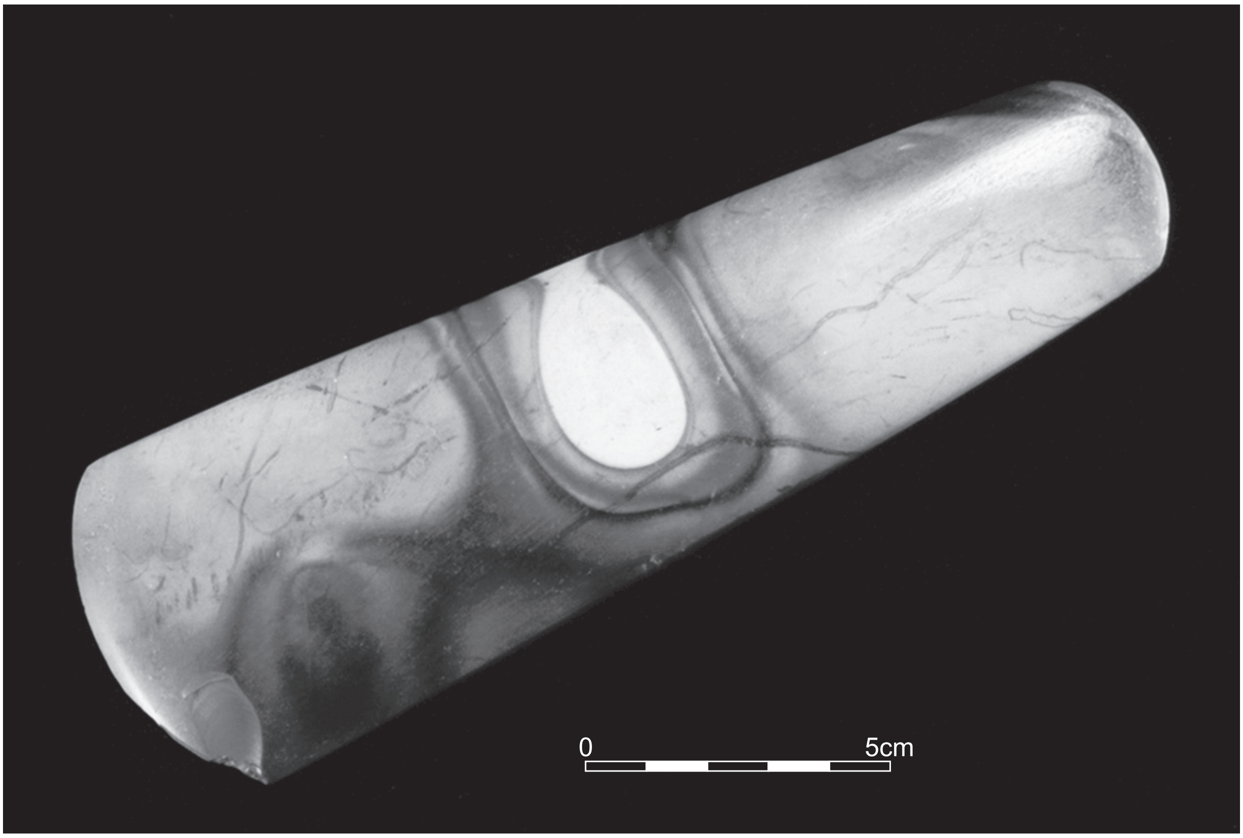


Fig. 15.11. The flint axehead from Bolshan Hill, Angus, Scotland. Photo: Alan Saville.

So in the run-up to and overlapping with the appearance of the first causewayed enclosures in southern Britain there were significant changes within the already established spectrum of material novelty and signification. Things moved further, and from a greater variety of sources, and some pottery was further enhanced by a rather limited range of linear and punctiform decoration, generally confined to rims, necks and shoulders.

Given its simplicity, it is perhaps understandable that rather little attention has been given to the potential significance of this decoration, though it would normally be assumed that the patterning applied to the upper parts and rims of pots acted as a visual symbol of some kind. Julian Thomas (1999, 101) has suggested that decoration was 'the product of unconsidered and routinised ways of working rather than an overt symbol of identity', 'drawing distinctions between persons, places and practices rather than large ethnic identities'. In a different context, study of increases in exterior decoration of serving vessels in the Puebloan south-west suggested a correlation with periods of increased social aggregation (B. Mills 2007). It is worth quoting a summary of trends (B. Mills 2007, 210):

> Across the northern Southwest, the first use of exterior designs and polychrome ceramics is during the Pueblo III period, which corresponds to a shift in settlement aggregation and open plaza spaces. With the transition to the more enclosed plazas of the Early Pueblo IV period, smaller and less visible exterior designs were used. The trend reversed itself with the use of larger plazas at later Pueblo IV period sites, where serving bowls with greater visual impact were used.

These trends (from roughly 1000 to 1400 AD) can be set in the context of the public performance of supra-household feasting, with all the senses actively at work, but especially visual perception of eye-catching things. The relative visibility of preparation and serving vessels is strongly suggested to correlate with the scale of participation in the sequence of feasting events (B. Mills 2007, 212); 'decorated bowls were focal points for the staging of consumption events' (B. Mills 2007, 234; cf. Blitz 1993).

In the southern British early Neolithic context, there is more than a chronological correlation between causewayed enclosures and Decorated Bowl pottery. The two have similar, although not identical, core distributions, excavated enclosures extending beyond the area where Decorated Bowl was current only in the south-west peninsula and Ireland. Among the 28 excavated causewayed enclosures which do coincide with the distribution of Decorated Bowl, the four which have yielded none are either sites with little or no Bowl pottery of any kind, despite reasonably extensive excavation, like Barkhale, or sites which have seen only very limited excavation, like Whitesheet Hill. Decorated wares seem to occur more consistently at causewayed enclosures than at other sites of the period, such as pit concentrations, hollows, treeholes and long barrows (Tables 14.8–9). Cleal has connected the variation

in repertoire from site to site, especially enclosure sites, with a general sense of local identities (Cleal 1992). Perhaps decoration was simply one further elaboration of the enchantment of technology, without explicit meaning (cf. Bloch 1995; Miller 2008), and acted in a tactile as well as a visual way, as pots were handled and lifted: part of the 'framing' of ritual and other events (Miller 1985, 181).

The Puebloan analogy can only be suggestive rather than exact. But whereas it has proved difficult so far to find clear signs of intensification in settlement or subsistence in the run-up to the first appearance of causewayed enclosures in southern Britain in the late 38th century cal BC, it has been possible to offer models for development and change in monument building and material culture. These are important clues to the nature of society. This was far from static. The probable rate of change, apparently accelerated by the 38th century cal BC, combined with the character of both monuments and material culture, now more strongly suggests a dynamic and perhaps competitive social setting. If competition and emulation were significant factors, however, it does not appear from the currently available evidence in southern Britain that these were principally to do with land or resources, but rather a spectrum of other concerns, perhaps including identity, affiliation, descent, genealogical seniority, connectedness and prowess in general. There are no easily available labels for this kind of situation, beyond the familiar and very general terms of social evolutionary schemes, though the language in which we might further describe this social setting is discussed again below in relation to enclosures themselves. When enclosures appeared, they did not do so out of the blue, and in introducing further changes, they quickened already accelerating trends.

15.6 Enclosures: the significance of a history

When enclosures first came to be built in southern Britain, probably in the late 38th century cal BC (Fig. 14.1), there was a long history of similar practices behind them. That story, going back to the LBK of central and western Europe in the sixth millennium cal BC, has been authoritatively summarised at least twice in recent years (Andersen 1997; Meyer and Raetzel-Fabian 2006), and its individual components have been analysed and discussed many times over (for example, from a *much* longer list: Bertemes 1991; Biel *et al*. 1998; Daim and Neubauer 2005; Dubouloz *et al.* 1988; 1991; Gronenborn 2007b; Jeunesse 1996; Matuschik 1991; Mordant and Mordant 1988; Müller 2001; 2010a; Petrasch 1990; Trnka 1991; Whittle 1988b), so that there is no need to rehearse all the detail here. It is sufficient to stress the main outlines of development, and important to underline that it is inconceivable from this perspective that causewayed enclosures in southern Britain could have been an innovation completely independent of that continental background, though this central claim need not commit us to arguing for universal uniformity of practice and meaning.

The broad history is constituted by the first appearance of enclosures in central and western Europe in the sixth millennium cal BC, in the orbit of the LBK, followed by the *Kreisgrabenanlagen* or rondels of various cultural groups in the earlier fifth millennium cal BC of central Europe, with simpler layouts, including interrupted ditches, found sporadically to the west, including in the Paris basin, and succeeded in turn by a plethora of interrupted-ditch and palisaded forms, across a broad sweep of western and parts of central Europe, beginning variably in the later fifth millennium cal BC and continuing well on into the fourth millennium cal BC (Andersen 1997). There was probably no single history in detail, since there was considerable diversity from the LBK horizon onwards, but one can discern long-term shifts in association and role, first within the longhouse world of the LBK and its fifth millennium successors, and then from approximately the mid-fifth millennium cal BC within the rather different setting of the Michelsberg, northern Chasséen and TRB cultures that variously come after the Danubian tradition. Both LBK and post-LBK enclosures were closely associated with longhouses, the former either variously enclosing them, or marking their former presence, and the latter – the rondels – more formally set apart from, but often demonstrably still close to, longhouse settlements, and more formally, symmetrically and elaborately laid out than those of the sixth millennium. The causewayed enclosure or interrupted ditch system came into its own in the later fifth millennium and subsequently, and was associated, as already noted above in this chapter, with a much more dispersed pattern of settlement, and perhaps altered forms of subsistence practice.

Diversity is worth stressing, though it is hard to catch all the many variables of size, duration, sequence, association and practice. Some LBK enclosures were set around large concentrations of longhouses, though the ditch at Vaihingen in Baden-Württemberg silted up in later stages of the life of the settlement (Krause *et al.* 1998); Langweiler 8 on the Aldenhovener Platte came at the end of a long sequence of house construction, perhaps gathering up and marking the space formerly between longhouses or longhouse groupings (Boelicke *et al*. 1998; Lüning and Stehli 1994). Some LBK enclosures may have been laid out in stages, and separate ditch segments are already apparent at Rosheim in Alsace (Jeunesse 1996). In contrast, many rondels may have been laid out in a single episode to a carefully predetermined plan, and many of their ditches show signs of rapid silting, though with phases of recutting and some overall remodellings (Andersen 1997). Moreover, the signs from ceramic associations are already that this was probably a chronologically concentrated phenomenon (e.g. Trnka 2005; Neubauer 2005), and Bayesian modelling in the future might, one could predict, suggest a narrow horizon within the earlier fifth millennium cal BC. On the basis of radiocarbon dates from vertical stratigraphies, Petrasch (1990) has already postulated a narrow horizon of construction in the 48th century cal BC. Elaborate layouts, largely empty interiors, and significant orientations combine strongly to suggest a special character, and it is

very tempting to see this as the manifestation of some kind of cult (one directed to sunrise has been suggested recently: Pásztor *et al.* 2008) which exploded across a significant area of central Europe, and perhaps equally rapidly lapsed again. Further west, at perhaps a roughly similar date or soon after, a large enclosure belonging to the Cerny group, and succeeding VSG houses, was constructed at Balloy les Réaudins in the Yonne valley of the Paris basin (Fig. 15.12), with some 60 ditch segments forming a single, oval circuit over 160 by 120 m in extent (Mordant 1992; 1997; Boureau 1997); mortuary enclosures are also found on the site, two famously directly overlying VSG houses. Finds in the ditch segments include pots, human skulls and deposits of animal bone (Mordant 1997). Other Cerny enclosures are known in the area of the Yonne-Seine confluence, including further lengths of interrupted ditches at Barbuise-Courtavant (Midgley 2005, fig. 12). Even earlier, in the Rubané récent of the Aisne valley, the single ditch circuit at Menneville had separate segments and enclosed seven longhouses (one of which intersected the ditch), with deposits in the ditch of both human and animal remains (Farruggia *et al.* 1996; Hachem *et al.* 1998).

So there was probably no single moment when the interrupted-ditch or causewayed enclosure idea came into being. The enclosure of L'Etoile, Somme, with its elongated ditch segments, and with 'epi-Rössen' or 'Rössen tardif' associations and probably to be placed in the middle of the fifth millennium cal BC, is also cited as relevant background (Jeunesse 1996; Bréart 1984). But then, according to current understanding of sequence and chronology, causewayed enclosures appear widely in the orbit of the Michelsberg and northern Chasséen cultures, and further afield, in the TRB (Fig. 15.13). Unfortunately, we do not yet know with certainty how rapid this process was. Following the standard relative chronology of Lüning (1967) for the Michelsberg culture, there appear to be plenty of enclosures in phases MKI–II. This span has recently been assigned, on the basis, one supposes, of visual inspection of radiocarbon dates, backed up by cultural connections to the Neolithic dendrochronologies of the Alpine foreland, to the period from 4200–4000 cal BC (Meyer and Raetzel-Fabian 2006, fig. 11; cf. Gronenborn 2010; Lichter 2010). It is to be noted again that an earlier start date for the Michelsberg culture, located in northern France, has been proposed, at *c*. 4500 cal BC (Jeunesse 1998; Jeunesse *et al*. 2004). While that issue is yet to be resolved, the clear current understanding is that early Michelsberg and corresponding early northern Chasséen enclosures belong to the late fifth millennium cal BC (Figs 15.14–19), and can be found quite widely from the Paris basin, as at Bazoches in a tributary of the Aisne, east to the Rhineland, as at sites like Miel, Mayen, Bruchsal 'Aue' (Reiter 2005), Ilsfeld (Seidel 2008b) and Urmitz, with examples known at least as far north as the Aldenhovener Platte, like Koslar 10 (Zimmermann 2006c; cf. Boelicke *et al*. 1979) and Inden 9 (Höhn 1997; Zimmermann 2006b).[8] The recent research of Michael Geschwinde and Dirk Fabian indicates that the whole northern fringe of the Lower Mountain Range possessed such enclosures *c*. 4200 cal BC and that Michelsberg enclosures were also present in some areas of central Germany (Geschwinde and Raetzel-Fabian 2009).

Also according to our current, imprecise chronologies, it is clear that not all causewayed enclosures belong this early. In the Rhineland, a couple have been assigned to MKIII/IV, estimated at 4000–3800/3700 cal BC, and then there, and to the east, a much larger number have been assigned to MKV, estimated at 3800/3700–3400 cal BC (Meyer and Raetzel-Fabian 2006, fig. 11; cf. Müller 2001), including substantial sites like Calden (Raetzel-Fabian 2000). Further to the north, the causewayed enclosures of Denmark, with one corresponding example in southern Sweden, belong only to the ENC–MNA1a–b phase, currently assigned to *c*. 3500–3200 cal BC on the basis of material associations and visual inspection of radiocarbon dates (Andersen 1997; Nielsen 2004). Southern Scandinavia thus follows a more linear path of monumental development, from early long barrows to early dolmens, with elaborated dolmens perhaps overlapping with the causewayed enclosures and passage graves perhaps concentrated in MN1b in the later fourth millennium cal BC (Nielsen 2004; Ebbesen 2007; Larsson 2008). In the Paris basin, interrupted-ditch enclosures may persist to the end of the complex of northern Chasséen and related cultural groupings at *c*. 3500 cal BC (Demoule *et al*. 2007b), but chronologies may not yet be refined enough (cf. Colas 2007) for as much precision as claimed further east. More recent fieldwork has found more enclosures to the north of the Paris basin, and closer to the Channel (e.g. Bostyn *et al*. 2006). In central-west France, as already noted above in this chapter, abundant enclosures probably belong to the fourth millennium cal BC rather than any earlier, but whether this regional tradition was flourishing before that of southern Britain remains for the present unclear. Further afield, southern Chasséen enclosures were in use from the later if not mid-fifth millennium cal BC (Vaquer 1990; Gandelin 2007; Beeching 1991; Demoule *et al*. 2007b).

As Christian Jeunesse has put it (1996, 258), 'Tout se passe comme si des pratiques encore faiblement codifiées dans les sociétés danubiennes acquéraient, avec le Néolithique récent, un caractère nettement plus stéréotypé'.[9] Although there is considerable diversity in size, layouts of ditch segments and palisades, site phasing and duration, these continental causewayed enclosures present recurrent themes: of bounding space in broadly similar ways, of marking presence by the deposition of material culture, animal bones and human remains, in ditches and interior pits, and of avoiding prolonged use for occupation or settlement. Thus, in terms of size, Urmitz, which bounds some 100 ha, is on a scale far greater than other Michelsberg enclosure (Boelicke 1978; Gronenborn 2007b), while the four closely placed circuits of Bazoches present a spatial complexity comparatively rarely seen across the whole Chasséen–Michelsberg–TRB orbit (Dubouloz *et al*. 1991; 1997). Both these examples may have gone through prolonged development, though

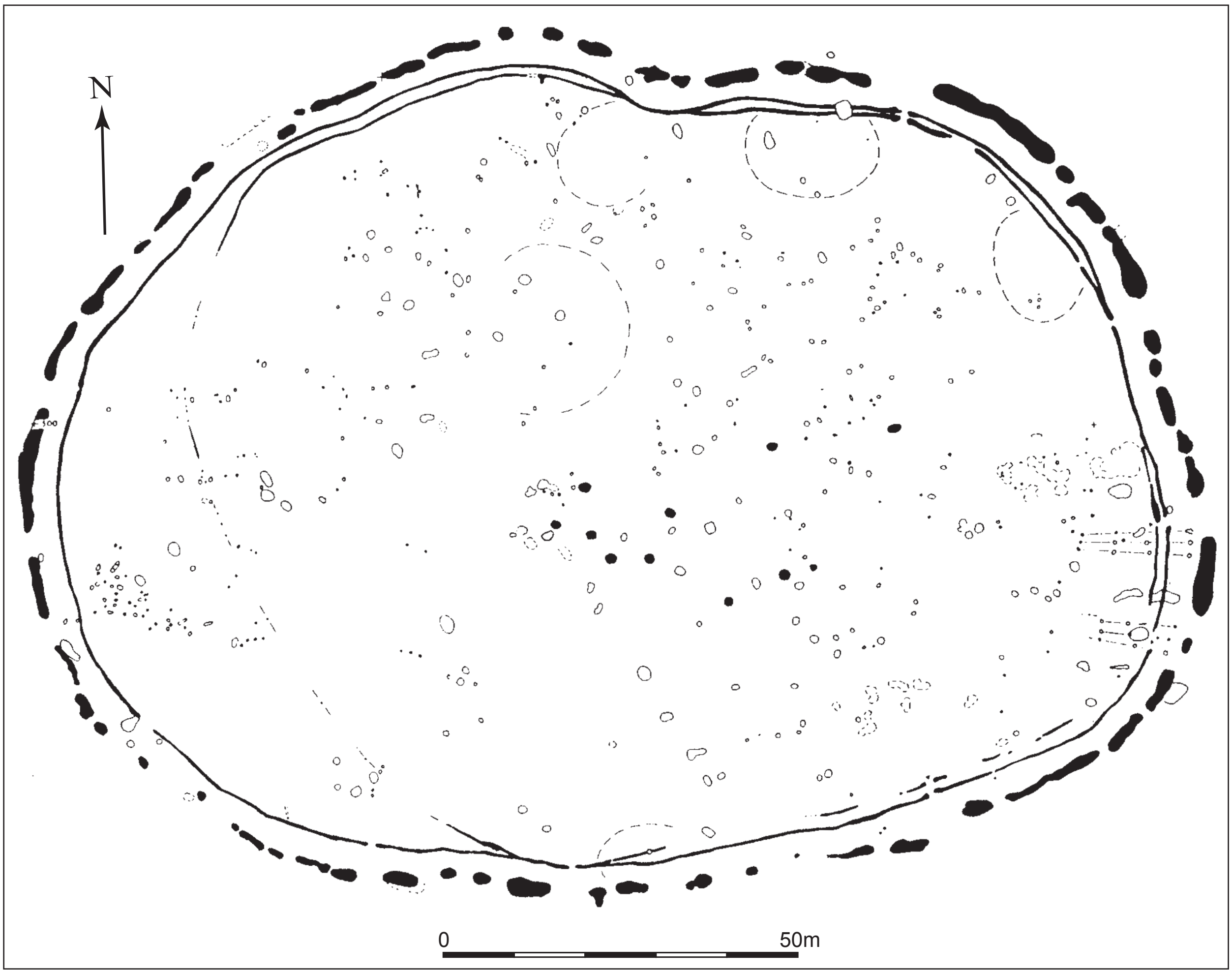


Fig. 15.12. Plan of the ditched and palisaded enclosure at Balloy 'Les Réaudins', Yonne, France. After Andersen (1997).

their duration has not been precisely established, while other enclosures appear to have been in use for much shorter periods of time. Recurrent are the practices of bounding space with at least one or two segmented ditch circuits, the ditch segments often aligned between multiple circuits, and normally backed by a more or less continuous palisade. Entrances may often best be marked by gaps or more formalised arrangements in the palisade circuits, and often by corresponding concentrations of deposition in adjacent ditch segments and ditch butt ends. Pottery, animal bone, and human remains are recurrent finds in ditches, often partial or fragmented. The deposit of whole animals at Boury-en-Vexin, Oise, is unusual (Lombardo *et al*. 1984; Meniel 1987), perhaps representing principally the deliberate slaughter of a whole herd of sheep (Rose-Marie Arbogast, pers. comm.); partial remains in lower layers of the ditch can be noted. Aurochs skulls spaced at intervals along the ditch circuits stand out at Bruchsal 'Aue' (Reiter 2005; Steppan 2003; Seidel 2008a). Human skulls and long bones are recurrent, but whole skeletons are not uncommon, particularly in central-west France (Semelier 2007). The substantial timber-framed buildings within the enclosure at Mairy, Ardennes (Marolle 1998), also stand out for their rarity. Much more common is the sporadic occurrence of pits, though these are occasionally present in more significant numbers, as within both phases of the (rather later) example of Sarup on Fyn (Andersen 1997). Finally, by way of this briefest of reminders – since the detailed literature is enormous – it is worth noting the work done in southern Chasséen contexts to establish the probable movement of both people and animals around the landscapes of the lower Rhône valley and elsewhere, across a range of sites from upland caves to lowland pit concentrations and enclosures (Beeching 2003; Gandelin 2007; Bréhard 2007).

It can therefore hardly be doubted that the general idea of enclosure construction and use in southern Britain was derived in some way from the adjacent European continent. Given the diversity apparent there, it is not necessary to argue for complete uniformity, because that never existed on the continent. Nor are the southern British causewayed enclosures identical with northern Chasséen or Michelsberg exemplars. In terms of layout alone, continental enclosures possess closely spaced ditch circuits, with aligned ditch segments, and backed by continuous palisades, far more often than is the case in southern Britain, though that combination does occur; Orsett is a case in point (Hedges and Buckley 1978; Fig. 7.8). But we need to go beyond

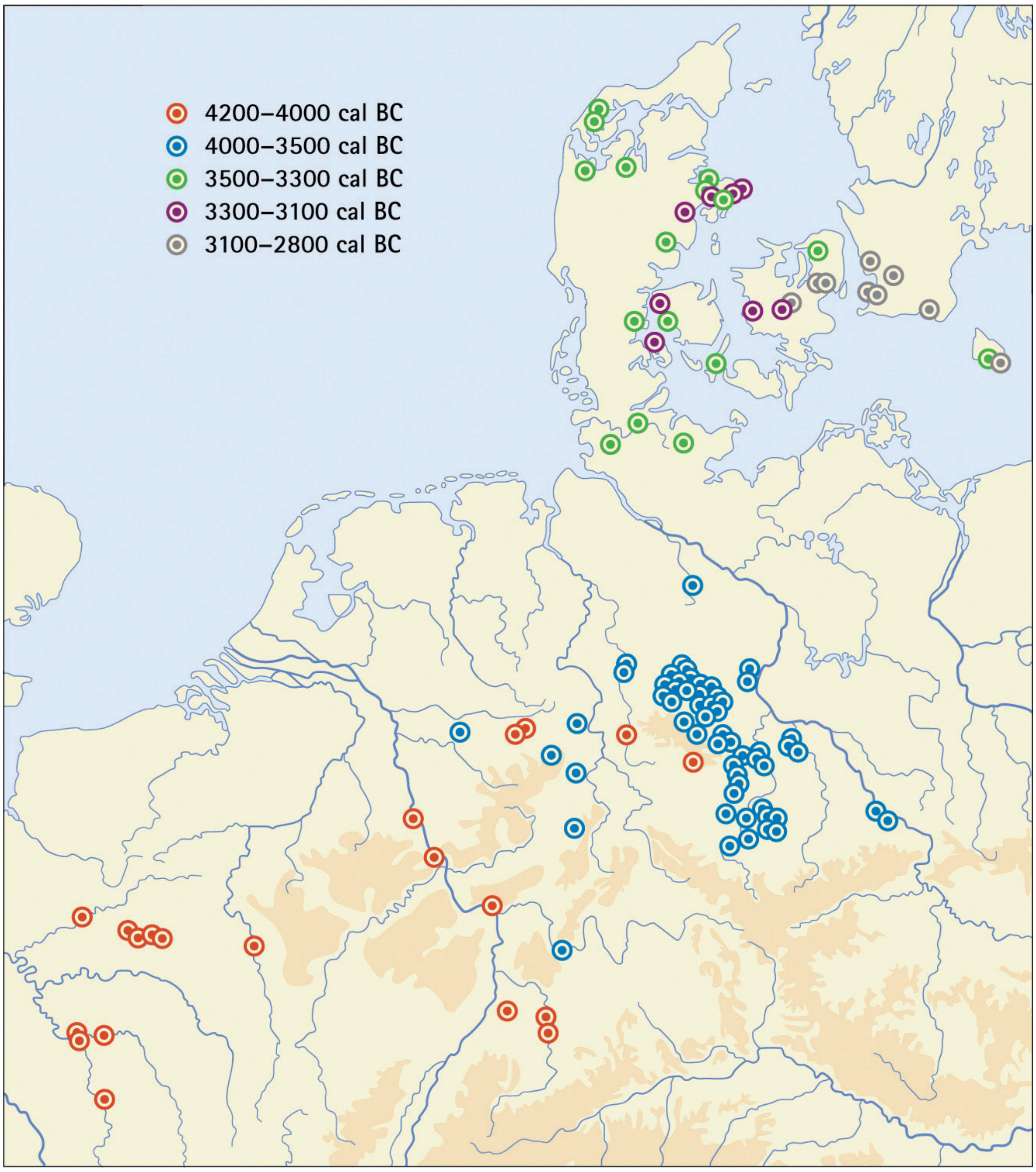


Fig. 15.13. Map of ditched enclosures from the Paris basin eastwards into Germany and southern Scandinavia, with informal date estimates from the late fifth to the early third millennia cal BC. From Müller (2010a).

the general links to ask what was adopted, imitated or emulated in the insular setting, and why at a particular date. It is clear that the longer enclosure tradition presented a powerful history: many, many generations back in the LBK, association with the great longhouses of the distant past, terrible killings at some (such as Asparn, Austria: Teschler-Nicola 1996), assembly and dramatic treatment of the dead at Herxheim (Zeeb-Lanz *et al*. 2009; Boulestin *et al*. 2009); and then the probable rush of great and elaborate rondel constructions. Those old doings might have attained the status of myth in the ongoing and still eventful performances of the enclosure tradition, across the range of impressive sites of recent history such as Noyen, Bazoches, Mairy, Boury, Urmitz, Bruchsal and a host of others. If links being made were to active continental practice, perhaps deepened by some kind of awareness of much older times, what was appealed to in the southern British case could have been an irresistible combination of myth and more active history (cf. Gosden and Lock 1998; Hodder 2006, chapter 6).

In the present state of information, it seems probable that the take-up of these ideas in southern Britain was principally to do with the acceleration of insular development. We cannot yet completely exclude the possibility of a fresh surge in continental enclosure construction from the 38th century cal BC, as hinted at in the synthesis of Meyer and Raetzel-Fabian (2006, fig. 11); if there was a cult-like quality to this, as we have argued earlier for rondels, that would perhaps explain the momentum of spread to and expansion within southern Britain. Nor can we completely exclude the possibility of further new arrivals in southern Britain. According to some of the colonisation theory reviewed above in this chapter, links with homelands are likely to have been maintained after initial movement, and it

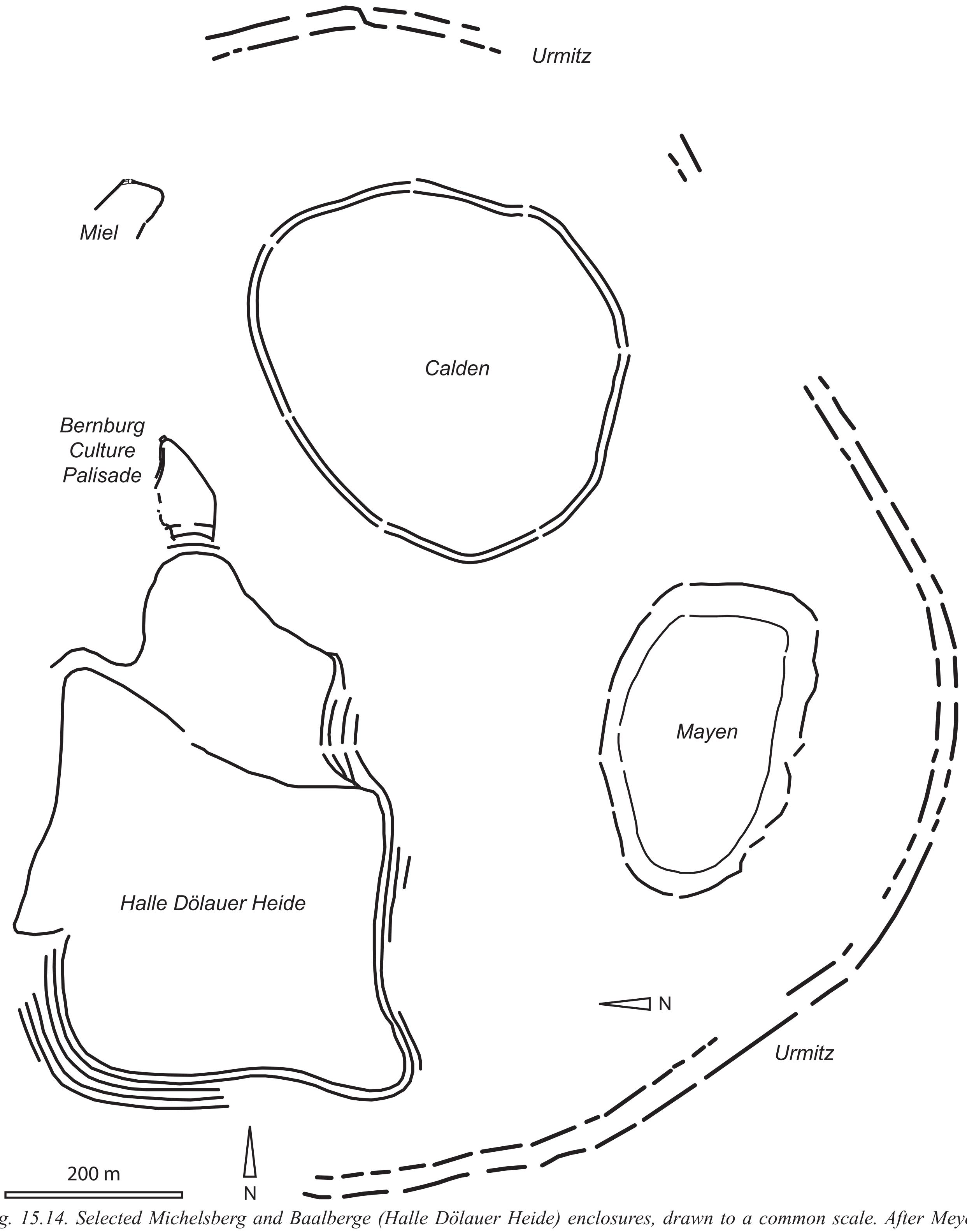


Fig. 15.14. Selected Michelsberg and Baalberge (Halle Dölauer Heide) enclosures, drawn to a common scale. After Meyer and Raetzel-Fabian (2006).

is not beyond the bounds of credibility that the appearance of enclosures in southern Britain is a manifestation of that. Against this idea, however, is a lack of other observable material change at this time which could be attributed to the outside; no one has suggested, for example, that the Decorated pottery style need relate to earlier fourth millennium continental inspiration. But in the context of continuing contact with the continent, seen also in the movement of jadeitite and other axeheads, communities, groups or organisers could have made more concerted and more dramatic use of distant things, whose impact as powerful innovation is well documented in anthropological

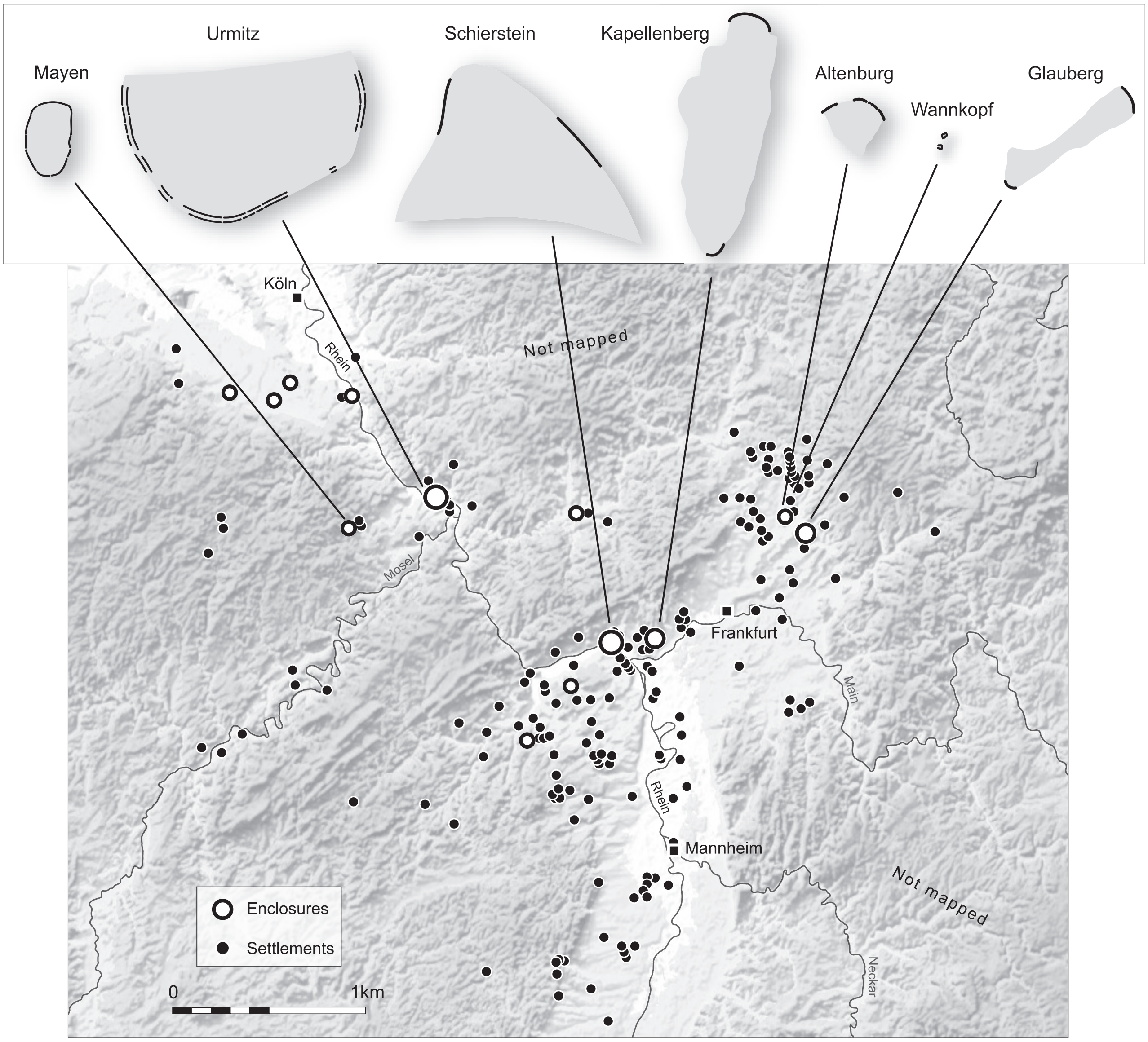


Fig. 15.15. Michelsberg enclosures and settlements in the middle Rhine and Rhine-Main area. After Gronenborn (2010).

case studies (e.g. Helms 1988; 1998). In her study of chiefdom societies, Mary Helms (1998, 11) suggests that:

> …connections with cosmologically defined origins-related outside entities, including other kin groups or even other polities, are essential not only to the formal outward expression of hierarchy but also to its manifestations, however uneven, within society and that the dynamics of internal social inequality and political jockeying are expressed most vividly in reference to such contexts, too.

The likely power of a nexus of connections to the outside seems clear, and we have already emphasised the apparently dynamic nature of change in southern Britain in the run-up to the appearance of enclosures.

Both the continental and insular sequences underline the puzzle of why, if enclosures were already part of continental practice in the later fifth millennium, they were not adopted at the start of the Neolithic. We believe that appeals to the outside, to the 'distant', and the novel, and not excluding the powerfully ancient, are best seen from the insular context; *local* organisation was needed to put new ideas into practice: through example, through persuasion, and through mobilisation of labour. It is striking, however, that once again the first enclosures were probably built in south-east England, closest to the continent and potentially most open to or familiar with contemporary continental practice (Fig. 14.16). In a longer perspective, this was perhaps the second call on the outside, if the initiation of long barrows and cairns and related constructions was at least in part related to such concepts. If those had become established by *c.* 3800 cal BC and enclosures appear probably just before 3700 cal BC, this is in itself a further clue to the acceleration of change. Did those who brought in enclosures seek to trump existing barrow-related practice? Were the two kinds of monument in some kind of opposition?

In the present state of information, we are not inclined

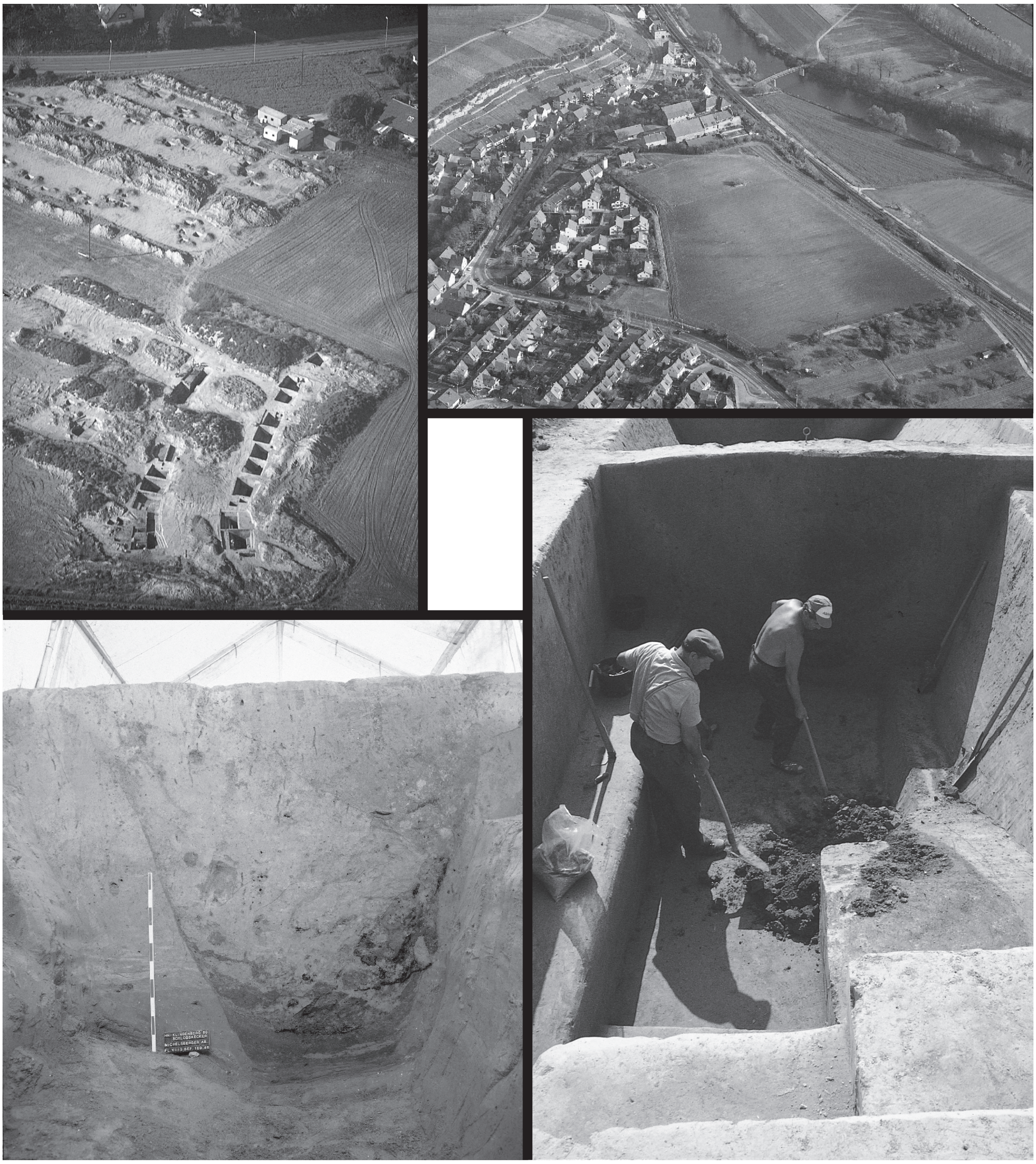


Fig. 15.16. Views of the Michelsberg enclosure at Heilbronn-Klingenberg 'Schlossberg', before and under excavation; the ditch section is in the inner ditch. Photos: Ute Seidel.

to explain the increase in interrupted-ditch and causewayed enclosures on the continent and in southern Britain by reference to climate change. Detlef Gronenborn (2007b), reviewing the Michelsberg expansion and Rhineland sites including Bruchsal 'Aue', Bruchsal-Scheelkopf, Hetzenberg, Ilsfeld and Heidelberg-Handschuhsheim, draws attention to instances of peri-mortem violence and burning, and implies that these are causally related to 'the 37th c. B.C. crisis' (2007b, 20), the claimed climax of a trend to cooler and wetter conditions in southern central Europe from *c.* 4000 cal BC (2007b, 16; cf. Schibler *et al.* 1997b; Magny 2004; Arbogast *et al.* 2006). The local effects of climate shifts can be debated even in the Alpine foreland (Whittle 2003, chapter 6), but it is obviously unwise to ignore the possibility of wider effects which might have increased the chances of inter-group competition for resources. The general difficulty here is that, even with the chronological uncertainties noted above, it appears that the beginning of the main phase of the continental causewayed enclosure phenomenon comfortably precedes the climate changes in question, so that enclosures of this kind as a whole can hardly be 'explained' by climate change, and the instances of possible violence are spread between the 40th and 38th centuries cal BC, on informal inspection of

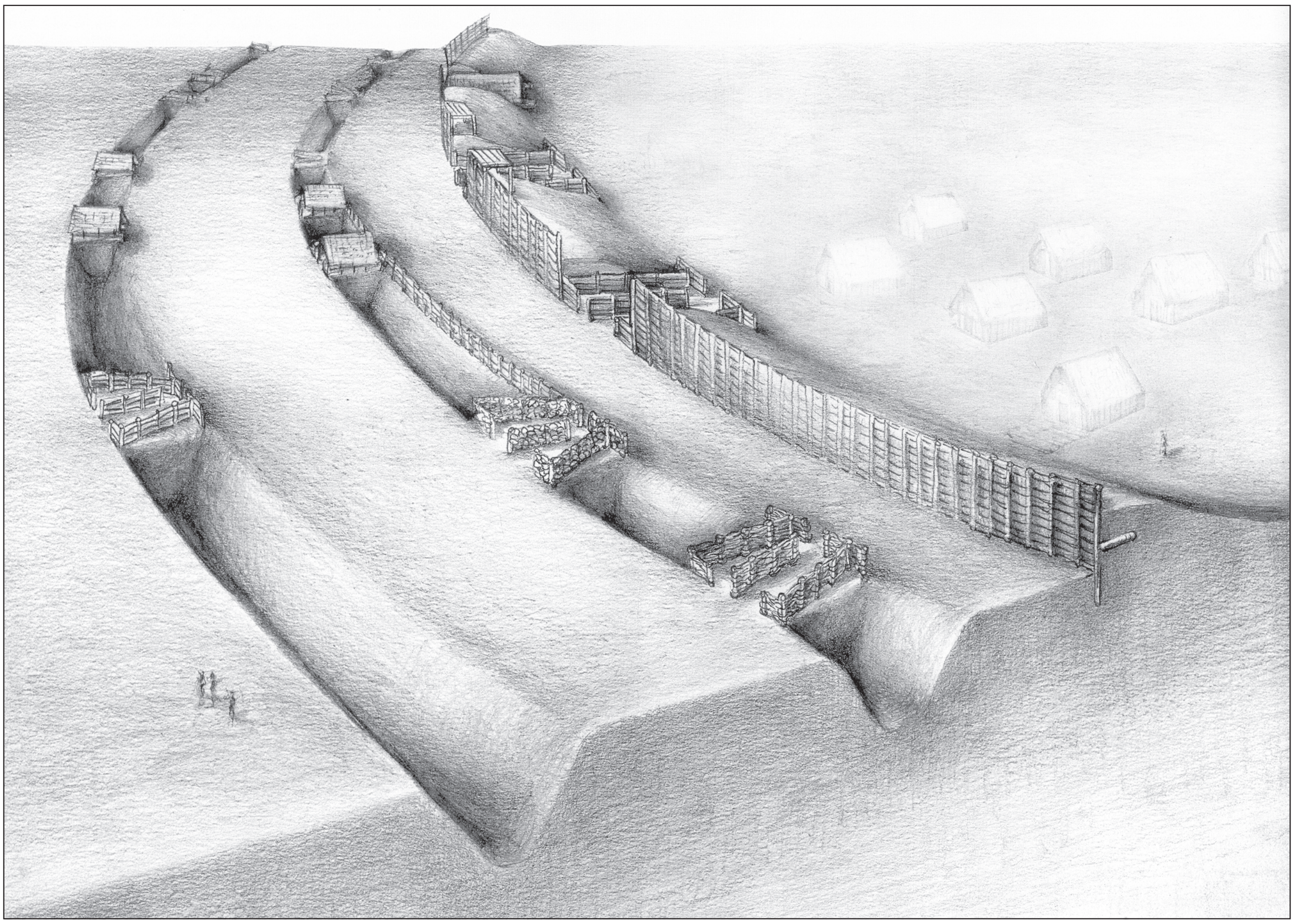


Fig. 15.17. Possible reconstructions of the circuits of the Michelsberg enclosure at Heilbronn-Klingenberg 'Schlossberg'. After Seidel (2010). Original drawing by S. Krisch, Tübingen; © Landesamt für Denkmalpflege Baden-Württemberg.

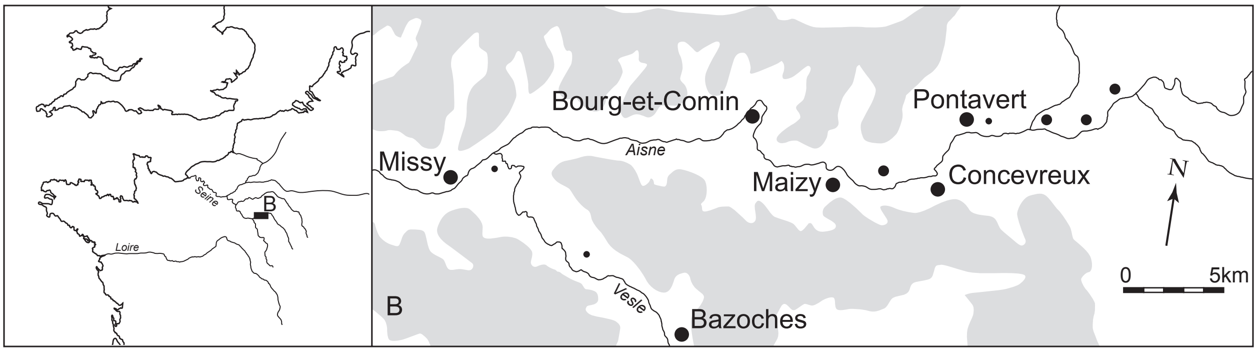


Fig. 15.18. Map of principal enclosures in the Aisne valley, France. After Andersen (1997).

radiocarbon dates, rather than concentrated in the 37th. Moreover, there may have been broad regional variations, with drier conditions mooted as characterising conditions further north in Europe 'around and after 4000 cal BC' (Gronenborn 2007b, 16).

Finally, it is worth noting again the relation between the continental enclosure history outlined above and the question of the dating of Magheraboy in western Ireland. If Magheraboy dates to very soon after 4000 cal BC, there would have been distant continental exemplars in existence, according to current understanding of chronologies, and probably closest in the Paris basin. So the wider history would allow its early date, as it were, but in turn that wider setting makes it all the more unusual at such a time, emphasised by the later dating of the enclosure at Donegore.

15.7 Enclosures in the making: places of innovation

So at a certain point in the southern British Neolithic sequence, dramatic new practices were initiated (Fig.

Fig. 15.19. Views of the enclosure at Bazoches, Aisne valley, under excavation. Photos: Jérôme Dubouloz, CNRS-INRAP.

15.23). We think that the circumstances of this innovation were probably competitive, with appeal deliberately made to things at a distance. Now, because we can trace genealogies of descent in the European enclosure tradition, it is easy to take this development for granted, but it is important to underline its novelty in the insular setting. Ian Hodder (1990, 260) referred to causewayed enclosures (and long barrows) as a 'monumental intervention in nature', and although the matter of attitudes to nature is perhaps an open question, this characterisation catches something of the change of scale seen in constructions from the late 38th century cal BC onwards. In another context, Tim Ingold (2006) has urged that we re-discover a capacity for astonishment, and that seems entirely appropriate here.

Enclosures had to be performed. In his discussion of the episodic, secret male initiation rites of the mountain Ok people of Papua New Guinea, Fredrik Barth noted that 'to assert a conception which is publicly compelling, can sometimes be far more precarious than other times' (1987, 61); in that context, 'a situation is created where the vision and commitment of a handful of senior men must be sufficiently strong to make it necessary for them to impose this ephemeral group identity on a vastly larger, ritually passive population which has no experience that calls for its conceptualization' (Barth 1987, 60). Faced with 'a receptive group of awed, attentive novices', the onus on the ritual expert is 'to make the mystery immanent, to spellbind himself and his novices with the experience' (Barth 1987, 44–5). The emphasis in the Ok case is on secrecy and episodic performance, at roughly ten-year intervals along the steps of initiation. That conditions the generation of variation, both through time and among neighbouring groups. How to do things may be held in the head of one person alone, and that not only places considerable emphasis on memory, given that 'most senior men had only fragmentary recollections of even the elementary initiations through which they had passed' (Barth 1987, 26), but also allows for plenty of creativity.

This comparison raises questions. It seems counter-intuitive to suppose that what went on at causewayed enclosures in southern Britain involved secret knowledge, given the scale of constructions and the probably large numbers of people involved. But in terms of *first* performances of the enclosure idea in a given region, as the practice spread, there may not have been prior knowledge among most of the participants of what precisely was to take place, even though individual elements – from digging to eating, or from material objects to their deposition – would have been familiar. So how did the practice actually get going? We have argued above that people with connections to the

Fig. 15.20. Aerial photos of Fornham All Saints, Suffolk, showing an angled cursus monument overlying two causewayed enclosures, looking north-west (above) and south-east (below). For the full plan, see Oswald et al. *(2001, fig, 4.25). Photos: © Suffolk County Council Archaeology Service.*

Fig. 15.21. The entry of guests into a funeral feast in the Torajan village of Banga, Indonesia. Photo: Brian Hayden.

continent both old and active brought it in, as a ploy in early Neolithic politics, to bolster their own position with awe-inspiring novelty. Were these people sufficient in number to materialise an enclosure by themselves, to lead, as it were, by example, or did they have to cajole and enchant followers and others, by performance on the one hand and enactment of things known only in myth and story?

There are several ways in which we could suppose that new participants or audiences could have been spellbound, once drawn in. First, it is probable that most enclosures were placed in new locations in the landscape. That is principally with respect to Mesolithic inhabitation; very few places of enclosure have signs of previous Mesolithic occupation. Perhaps that is just accident, but there is not the continuity (or is that too to be dismissed as fortuitous?) seen between pre-cairn Neolithic occupations and cairn constructions at sites like Gwernvale, Hazleton and Ascott-under-Wychwood (Britnell 1984; Saville 1990; Benson and Whittle 2007). There are also comparatively few signs of pre-enclosure early Neolithic activity directly on the spot at the majority of causewayed enclosures; the regional chapters give details (and the complications of interpretation) for, among others, Windmill Hill, Maiden Castle and Hambledon Hill (see also Mercer and Healy 2008, 53–4). There are of course several locations where long barrows are in varying degrees of proximity to enclosures, and in line with the discussion in section 15.4 it is probable that at least some pre-date the enclosure horizon. Those at Hambledon Hill are probably the physically closest, though it is not clear (*67% probable*; Table 4.4) that the southern long barrow there actually pre-dates the main enclosure, or at least predates it by much (Figs 4.10, 4.14, 4.17). The distinctions are not necessarily clear-cut, but many enclosures could have been deliberately sited to be in locations without visible or deep pasts, and to enchant by their freshness.

Secondly, however people were persuaded or motivated to contribute their labour, there would now have been bigger numbers involved than earlier. We cannot exclude the possibility of large gatherings preceding the formalisation of enclosures, as argued previously in general terms by John Barrett (1994), but the mobilisation of labour for enclosure construction is surely greater than that required for earlier building enterprises, even when site histories can be broken down into episodes of successive activity, for example at Windmill Hill (Chapter 3.1) or Hambledon Hill (Chapter 4.1); in some cases, for example at Maiden Castle (Chapter 4.3) and Abingdon (Chapter 8.5), it is probable that the mobilisation of labour was swift. There would have been a new kind of bodily consciousness for anyone involved in the construction of a ditch circuit, even if the experience of digging a single circuit need have been little different to that, say, of a substantial long cairn quarry, for example as at Hazleton and Ascott-under-Wychwood in the century before enclosures took off. This new kind of embodiment would have been accompanied by a potentially greater

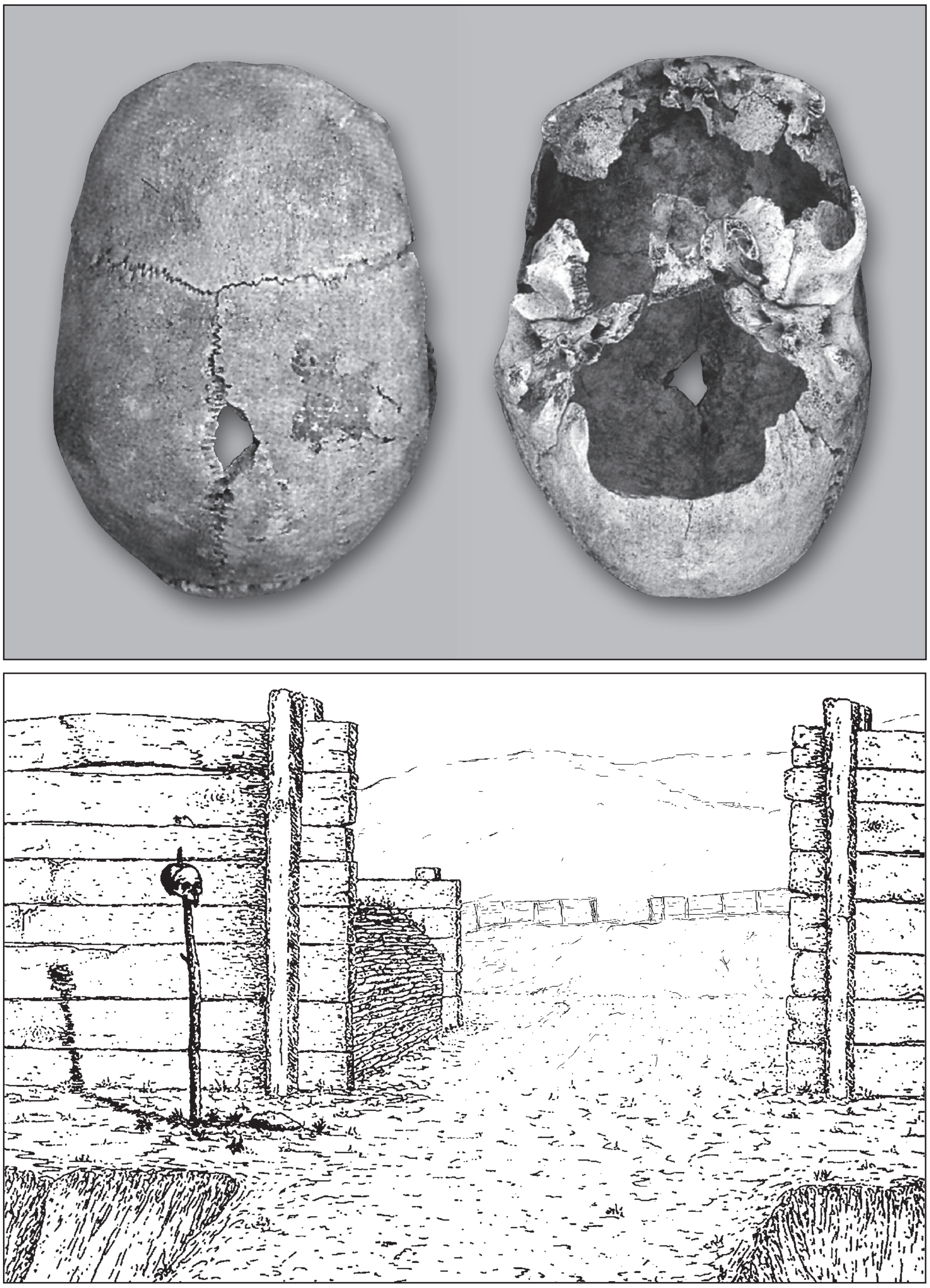


Fig. 15.22. Perforated skull from the Michelsberg enclosure at Ilsfeld, Germany, and its reconstructed position in the ditch system. After Wahl (2000).

scale of sociality, with more people perhaps spending more time together on a single shared task than would regularly have been the case in day-to-day contexts. Nor should we forget the result of this shared labour in its own right. The phrase of Hodder quoted above gives major importance to ideas of the wild and nature, but we can equally place prime emphasis on the space, form and scale created by enclosures in themselves, and re-imagine the astonishment and enchantment of both builders and subsequent witnesses.

Once initiated, with demonstration of effective performances, it is easier to envisage the spread of the practice, with sufficient temporal intervals in the early years, combined with spatial separation, for diversity to be generated as in the Ok case noted above. Might the history of the spread of Neolithic things and practices, discussed above, also help in part to explain the differing distributions of enclosures in southern Britain? Could it be that in certain areas ritual experts, initiators and organisers, or people in general, chose to emphasise their remembered history in part by the frequency with which they made use of the enclosure idea? As presently recorded, there are three areas with particular concentrations of enclosures: on the Sussex downland, in the lower Welland and Nene valleys, and in the upper Thames catchment (Fig. 1.2). The Sussex enclosures are in an area where Neolithic activity goes back probably to

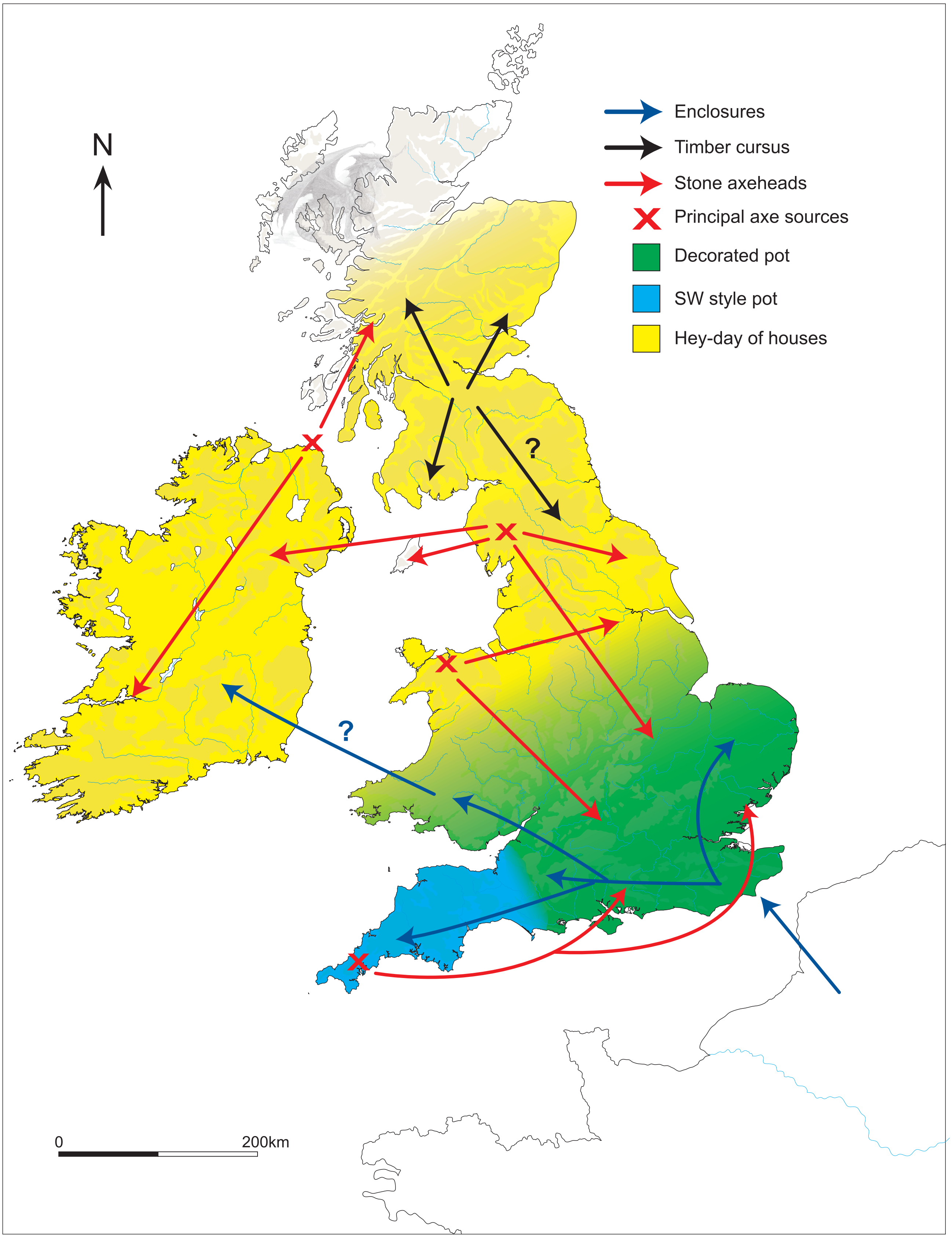


Fig. 15.23. Interpretive map of selected shared practices and networks forged in the generations around 3700 cal BC in Britain and Ireland. Compare Fig. 14.181.

the 40th century cal BC, while those of the upper Thames, flanking and overlapping with those of the Cotswolds, are directly adjacent to an area where Neolithic activity also goes back probably to the 40th century cal BC (Fig.14.54: *start Sussex Neolithic* and *start Cotswold Neolithic*). The possible correlation with early beginnings is less clear, however, in the lower Welland-lower Nene case, and in general enclosures are found west of the East Anglian fens (Fig. 14.54: *start eastern Neolithic*; Chapter 6). There is, moreover, no particular concentration around the Greater Thames estuary itself, though numbers there have increased impressively in just the last few years (Chapters 1 and 7). There can be other ways to think about the differing distributions and site biographies within the dominant 150-year span of the enclosure idea, which we go on to discuss now in more detail.

15.8 Things that mattered: the generation of worldviews

Over the years there have been many general models of the meanings and significance of causewayed enclosures, many tending to agree with the summary view of Richard Bradley (2007, 74) that, despite diversity among sites, 'perhaps they were aggregation sites where public events took place'. These interpretations are summarised in Chapter 1.3. One of the most nuanced discussions stressed ambiguities and changes through time as well as diversity, suggesting among other themes the coming into existence of 'dominant locales' and (following Appadurai 1985) the practice of 'tournaments of value', involving the 'renegotiation of the value and significance attributed to objects obtained through a variety of social networks', and 'crucial for the reproduction of relations between dispersed communities' the provision of 'a bounded context in which a variety of practices that exposed the fabric of society could be undertaken and their interpretation controlled' (Edmonds 1993a, 108, 124–5). Although accounts of this kind regularly stress diversity, there are also many recurrent features, from styles of circuit construction, and the numbers of people implied, to the character of materials and residues found and the manner of their placing in the ground; communal construction, large-scale assembly, feasting, and patterned deposition of materials, food residues and remains of the human dead, are all parts of a canon of practice at causewayed enclosures widely accepted in Neolithic scholarship. Enclosures can be seen at one level as part of a repertoire of containers prevalent in the early Neolithic, which also includes pots, pits and barrows or cairns.[10] At the same time, interpretations of individual sites published over the last 20 years or so underline the diversity stressed in generalising accounts. Thus the report on Haddenham has emphasised a relatively brief but ongoing history of the mobilisation of labour, to create a 'great clearance', mimicking other aspects of woodland life (Evans and Hodder 2006); that on Hambledon Hill has recently stressed a 'frontier' position, the site aligned to others to its west and suggestive of 'quasi-political unity over long distances and equally quasi-political prominence for some sites as 'symbolic' of the social solidarity that they had come to represent'; attack and defence were prominent aspects of this world of the west (Mercer 2008a, 777; cf. Mercer 2006a; 2006b). Windmill Hill was seen to present a whole range of dominant concerns of early Neolithic society, arranged purposefully across its three circuits, to help people to create symbolic order (Whittle *et al.* 1999). The interpretation of Etton also underlined a spatial logic behind the character of deposition on either side of the single circuit, playing out domestic and funerary activity in periodic activity (Pryor 1998). Maiden Castle, finally, was seen as a locale for the negotiation of important but potentially dangerous rituals of social interaction, deliberately placed in an out-of-the-way setting (Sharples 1991a; cf. J. Evans *et al.* 1988).

What the present study adds above all is a sense of timing and tempo (cf. Bayliss *et al.* 2008b; Whittle and Bayliss 2007). We concentrate in the first place on the hey-day of the construction of causewayed enclosures over 150 years in the 37th century cal BC and the first half of the 36th century cal BC (Fig. 14.7). This overlaps with the ongoing history of the long barrow and long cairn tradition. We will then consider the later lives of those causewayed enclosures – and some long barrows and long cairns – which continued in use after the middle of the 36th century cal BC, from which time onwards cursus monuments were the next monumental innovation, at least in the south of Britain, and long barrows and long cairns continued to be used (Fig. 14.45). It is clear that we need to work at different scales, tacking between what is shared and what is particular to individual sites and parts of sites, and there is the opportunity now to consider both the timing of individual enclosures in the developing tradition and the overall tempo of the phenomenon as a whole. We will first reconsider some of the generalities already noted through the lens of temporality, before looking again at individual sites first presented in the regional chapters.

So far, the discussion may be seen as having taken enclosure form for granted. Some time ago, however, quoting the dictum of the French Symbolist poet Paul Valéry that projects are never finished, only abandoned, Christopher Evans proposed that we should think of 'prehistoric constructs as *projects*' (original italics), which were 'resolved (conceived) only through their construction'; 'given spatial qualities may only have been 'emergent' in the sequence of their construction' (C. Evans 1988b, 88). Questioning the application of notions of formal design, with particular reference to the Haddenham enclosure, he proposed that 'some aspects of the enclosure planning/layout…were not conceived in the initial stages, but *emerged* later in its construction/maintenance' (Evans 1988a, 130; original italics). The inner circuits of multiple constructions were proposed as probably the earliest features, a visual core from which subsequent concentric circuits were laid out (Evans 1988a; 1988b, 91). This view has since been quite widely followed in the literature on monuments in general (e.g. Barrett 1994; C. Richards 2004;

McFadyen 2007; discussed critically by Whittle 2006), and has been discussed again recently with reference to Hambledon Hill and other causewayed enclosures (Mercer 2006a, 69).

What emerges from the present study is something more complex. Clearly, some sites were modified over considerable periods of time, and in that sense were indeed ongoing projects. Hambledon Hill is probably at present the classic example, but we could add Crickley Hill, and perhaps Whitehawk, as well as Hembury and others. But the *initial* project at Hambledon, the construction of the inner main enclosure, and other examples like the first, interrupted circuits at Crickley, whether or not they were successive, present what Roger Mercer (2006a, 69) has called 'unitary conceptions': coherent, circular layouts, which appear at the level of precision achievable within the available modelling to be of a single date. The same probably applies to single-circuit enclosures like that at Etton – even though that was modified in subsequent phases. There is at least one example where the model of successive elaboration from an inner core can be supported: that of Windmill Hill, though the order was probably from inner to outer to middle, with the construction and primary use of the West Kennet long barrow in the probable interval between outer and middle circuits (Chapter 3.4; Fig. 3.28). In all these cases, and others, there seems little reason in fact to doubt the intention of enclosing space in predetermined form. That leaves other interesting issues, such as whether only the ritual experts involved in the first enclosure knew what they were about to do, such that form would have been *revealed* during and by the building process: a rather different perspective to that initiated by Christopher Evans. It is also worth reflecting on whether forms created were the same as forms planned or broadly agreed. Was, for example, the kidney-shaped layout seen at Haddenham, Briar Hill and the inner circuit at Windmill Hill, an on-the-spot compromise or shortening of the initial enterprise?

The brevity of many individual constructions rather than their lack of design can now be stressed. As discussed in Chapter 14, some were subsumed in longer histories. The longest-lasting enclosures now stand out as exceptions rather than the rule, and the development of Hambledon Hill, Windmill Hill, Crickley Hill/Peak Camp and Etton was different in each case. There were also episodes of construction within the medium-length histories of a century to a century and a half, as at Chalk Hill and Hembury, though the dating of the former was largely confined to one circuit. The enclosures of short duration, such as St Osyth, Abingdon and especially Maiden Castle, were not of the simplest form, nor the smallest. The three circuits at St Osyth were not directly dated; the two at Abingdon were either coeval or built within a few years of each other, as was probably also the case for the two closely spaced and impressively large circuits at Maiden Castle. Maiden Castle appears to belong to the latter end of the hey-day of causewayed enclosure construction. The models for both St Osyth and Abingdon are strongly bimodal. This suggests their construction in the 37th century cal BC on the one hand, but also allows it in the middle portion of the 36th century cal BC, which raises the intriguing possibility that the enclosures of the shortest duration tended to belong to the end of the tradition, either because events and fashions then moved on, or because circumstances at that point in the tradition required dramatic, brief performances.

Timing and tempo bring fresh perspectives to the business of assembly, first in the mobilisation of labour. This has been extensively discussed for Haddenham, the model proposed being one of a relatively short history of ongoing construction and modification, say over 50 years or fewer, involving a labour pool of hypothetically not more than 100 people working seasonally and a group of users suggested as '100–200 individuals or 10–40 residential/familial groups (or 3–7 'lineages')' (Evans and Hodder 2006, 328–9). Frustratingly, it was not possible to date that enclosure with any precision. Figure 4.18 presents estimates for the input of labour through the episodic history of Hambledon Hill. Apart from the late flourish probably in the 34th century cal BC involving the western outworks, the major input of labour was in the early phases of the site, in the first half of the 37th century cal BC. Roger Mercer has also proposed (2008b, 751) a '100 person' model, working perhaps in stints of 80 days a year over one or two years. While we need not impose any uniformity in the circumstances of construction, given all the other evidence for diverse practices, this order of magnitude would probably cover many other cases as well. As Mercer has commented (2008b, 751), this would not have been 'a major undertaking for a population of 1000 (100 families) who thought that it was important enough'. But we can now emphasise the increase in the overall tempo of construction during the course of the 37th century cal BC, with a lull at the turn of the century and a renewed burst of activity in the first part of the 36th century cal BC (e.g. Fig. 14.20; to all of which we return in section 15.10, in further discussion of Neolithic politics). We can also reflect on the difference in the social conditions of the mobilisation of labour compared with the 38th century cal BC. We would probably not normally think of 100 families or 1000 people behind the construction of an individual long barrow or long cairn, not least given the overall numbers in the Cotswolds, where estimates of barrow/cairn use-lives of 50 years' duration over a period of some 200 years suggested some 29 such monuments in operation at any one time (Whittle *et al.* 2007a, 137). So we are probably witnessing an increase – though one very hard to quantify – in the scale of labour mobilisation, and probably also an overall acceleration in the large-scale mobilisations through the 37th century cal BC. There need not be uniformity or regularity. The Windmill Hill area suggests difference from generation to succeeding generation, with first the modest enterprise of the inner ditch, then the crescendo of the construction of the great outer circuit, followed by the perhaps much more traditional and limited undertaking of the West Kennet long barrow (though still on a locally impressive scale), and finally

capped by the task of intermediate demand required by the building of the middle circuit. A subsequent generation again may have built the much smaller enclosure on Knap Hill 8 km to the south (Fig. 3.32). Maiden Castle at the end of the hey-day of enclosure construction again offers intriguing possibilities of change. It encloses an area more or less the same as the main inner enclosure at Hambledon Hill, but its ditches were probably doubled right around the circuit, in contrast to Hambledon's, and would thus have required twice the effort of construction in a very short space of time.

The other aspect of assembly concerns what people did at enclosures once constructed. Here there are considerable challenges to interpretation, first since it is normal (and understandable) practice to infer the character of activity directly from the materials and residues to hand, and secondly because it is very difficult to scale the numbers of people present. Thus recurrently abundant (though varying) numbers of animal bones have often been taken to signify large-scale consumption (e.g. Whittle and Pollard 1998; 1999), and it is easy to move from that interpretation to the assumption that feasting was a dominant activity at such sites, and a goal in its own right. Other material such as lithics, including imported stone and flint axes, and pottery, is incorporated in such views either as by-product of temporary gatherings or as a sign of some (but limited) more prolonged occupation. An older view of course saw enclosures as seasonal places to deal with cattle management. Only rarely in more recent times have more specialised roles been suggested, the interpretation of Offham for example, where finds were in general very scarce, as a place to deal with the dead (Drewett 1977), standing out from the more common generalising views. What if, however, we have overlooked possible specific purposes? Should we go back to cattle kraals? To take just two examples, the presence of live cattle at Etton has been strongly suggested by beetle evidence, and at Northborough by phosphate analysis (Chapter 6.4). Some of the evidence for defence and attack, discussed further below, could be to do with cattle raiding. But then hilltop locations at least are not good places to keep cattle for any length of time, nor is the concentration of vulnerable herds in one place necessarily a better tactic than dispersal. Perhaps also smaller enclosures (like those say at Thornhill and Knowth in Ireland) might be expected to be a more common feature of the early Neolithic landscape in southern Britain if these cattle-oriented conditions were general.

Another possibility for a specific role could be that many enclosures were involved with treatment of the human dead and especially with subsequent mortuary and commemorative rites. We have already seen the presence of the dead at continental enclosures, and there are variable numbers of human remains in southern British examples, though the model of involvement with mortuary rites does not require consistent quantities. They are encountered, among others at Windmill Hill, Hambledon Hill, Maiden Castle, Whitehawk, Etton, Staines, and Abingdon (Chapters 3.1, 4.1 and 4.3, 5.1, 6.4.1 and 8.5). There are whole bodies and parts of bodies; on-site exposure has been suggested for Etton (Pryor 1998, 362), and for Hambledon Hill (McKinley 2008, 497–504). There, the human remains in general, like the animal bones from the site, were subject to damage from dogs and rodents, but the human material (as at Etton: Armour-Chelu 1998b; Pryor 1998, 362) was in general more weathered and degraded than the animal material; 23 finds of human bone, both articulated and disarticulated, also have cutmarks (McKinley 2008, 497–504). Some crania were deposited on their own, including on the base of the main enclosure ditch, and several have been noted as particularly weathered and worn; other contexts also suggest some curation of other bones (McKinley 2008; Mercer and Healy 2008, 759–60). Alongside the evidence for differential treatment, there are also links; at Windmill Hill, the femur of a human juvenile was inserted into a *Bos* humerus in the inner ditch (context 630: Whittle *et al.* 1999; Wysocki 1999; *contra* Pariat 2007, 122), and at Etton the excavator noted the resemblance between crania and upturned pots, for example in segment 7 (Pryor 1998, fig. 31, and 370).

So, without going into all the site detail, selected individuals and parts of bodies are deposited from time to time, often without apparent ceremony, in the non-ordinary context of the ditches (and sometimes other features) of enclosures. This raises the question of audience. What sort of gatherings did such depositions entail? Are we to suppose small, restricted groups of mourners – familiar perhaps from the modern perspective – or something on a much larger social scale, full of noise and public drama, involving many more people (cf. Parker Pearson 1992)? What, too, of the emotions aroused by such occasions (Metcalf and Huntington 1991, chapter 2)? Were these selected persons deposited without emotion, because removed from an ordinary social context, or did such a setting enhance the grief and anger of the occasion? The wider possibilities sit well with the conception of enclosures as places of collective labour and shared assembly, but the fact that we have not so far normally sought to attempt such a distinction in the character of mortuary or funerary activity underlines the problematic nature of burials at enclosures. It is noticeable that while the interim report on Hambledon Hill drew attention to the 'vast, reeking open cemetery' represented by the main enclosure (Mercer 1980, 63), discussion in the final report is much more muted on this theme, stressing social hierarchy and defence far more (Mercer and Healy 2008, 759–60; Mercer 2008a). And if personhood or identity was distributed, not confined conceptually to the singular body (C. Fowler 2004a; Whittle 2003), then we can also think not only about the body as redolent with meaning but also about human remains in general as a symbolic resource. Individual remains may work metonymically, part for whole, distributing identities and relations. It would now be an interesting programme systematically to date crania and other remains from primary contexts to see if curated, old material was brought into the enclosures.

Should we be content with the concept of simple

funerals, when we know from ethnographic studies that funerary rites may extend for years after a death, and that processes of forgetting (Forty and Küchler 1999) can be as important as chains of memory? In the case of the Bara people of Madagascar, burial is followed by gatherings and feasts, and eventual reburial. 'Death and burial are often shocking events that disrupt the normal flow of village activity. But the gathering and reburial events are experienced as an annual season of festivities…' (Metcalf and Huntington 1991, 116). Such gatherings are the biggest in Bara social existence, involving hundreds of people and the killing of up to a dozen cattle. But there are dangers as well, seen in wrestling, dancing and cattle riding, and there is a lurking fear of witchcraft. Fighting may result, and the gatherings end after a few days (Metcalf and Huntington 1991, 118–20).

Drawing on a wider range of examples from south-east Asia, Indonesia, Melanesia, Polynesia and the north American Northwest Coast, Brian Hayden has stated (2009, 29) that 'funeral feasts in traditional societies often constitute the single most important and costly event in the history of a family'. While noting other interpretations of excessively lavish feasts in terms of 'ideological cultural traditions' or with the need to impress the dead themselves, so that the ancestors will 'dispense fertility, wealth and success on their living descendants', he mainly promotes a view of the feast in 'transegalitarian' societies (notionally intermediate between egalitarian bands and stratified chiefdoms) as 'critical in obtaining political, social and economic advantages' (B. Hayden 2009, 30–1; see also Dietler and Hayden 2001). Funeral feasts in Indonesia, however, are concerned with more restricted goals (Fig. 15.21). They can occur long after a particular death, blurring the distinction between funeral and commemorative feasts. They can vary in scale, duration and size of audience, in Sulawesi from one–two nights with one pig and possibly one water buffalo, right up to the rare instance of 27 or more nights with more than 36 pigs and 16 water buffaloes (B. Hayden 2009, 32; Adams 2004). More than a thousand people can attend the more lavish events. Hayden stresses the ostentation, which may transgress normal egalitarian values, and the desire to invite and feed 'as many people from as large an area and as high rank as possible' (B. Hayden 2009, 33), which serves to create and cement alliances, marriage opportunities, openings for trade or exchange, and self-protection against the potential aggrandisement of others (B. Hayden 2009, 35–6). Finally, he underlines the sensuousness of feasts, their unusual foods, dramatic performances and symbolism, the emotions generated, the social closeness and intimacy generated (B. Hayden 2009, 38). 'Of all the pretexts that might be good for holding alliance or promotional feasts, funerals are probably the most suited' (B. Hayden 2009, 39), because of the emotional malleability and receptiveness of the participants.

Would such a specific role for causewayed enclosures work? It could encompass the human remains already noted, and many of the other finds including the animal bone assemblages. It could allow for differences within, for example, the Hambledon complex, with the Stepleton enclosure having an apparently more domestic role than the main enclosure (Mercer and Healy 2008). It might help to make partial sense of the relationship between causewayed enclosures and surrounding long barrows and long cairns; generally as already noted, the greatest concentrations of barrows/cairns coincide or are adjacent to the largest clusters of enclosures, though the lower Welland/lower Nene group is an exception to this pattern. And finally, the appearance of enclosures in the sequence could be seen as coming at a point when funeral and commemorative rites were becoming more elaborate and were taken into a wider domain, reflecting the putative competition already noted above. The relationship between Windmill Hill and West Kennet long barrow has already been noted. Other potentially similar relationships can be considered. At Hambledon Hill, for example, the excavated example of the two long barrows was one of the earliest elements of the complex (Table 4.4; Figs 4.14, 4.17), and was thus extant as enclosure construction continued. Nonetheless, the four barrow/cairn endings dated to the later 37th century cal BC – those of Ascott-under-Wychwood, Hazleton, Fussell's Lodge and West Kennet (Whittle *et al*. 2007a, fig. 9) – come strikingly at the point when enclosure construction was reaching its first peak (Fig. 14.20). So is this just coincidence, or were long barrows and long cairns at least temporarily or locally eclipsed as arenas where the dead and their spirits were set to rest?

Attractive though a specific or principal role like this might be, it does not seem to explain quite enough. It can be objected that it is difficult to separate funeral or commemorative feasts from a wider spectrum of public events of this kind (e.g. Dietler and Hayden 2001), and the particular goals inferred by Hayden may not be dominant over other motives including sorrow, closure, mourning, pacification of the dead and so on (e.g. M. Jones 2009; Hastorf 2009). And what of the other kinds of deposition, and the evidence for defence and attack? It is perhaps therefore safer to fall back on those more generalised and diverse kinds of role already frequently advocated for enclosures, as places of aggregation, negotiation and transformation (e.g. Edmonds 1993a; 1999; J. Thomas 1999; Evans and Hodder 2006; R. Bradley 2007; Mercer and Healy 2008). We could gloss these general themes further, by stressing the importance, given the sequence which we have been emphasising, of principles of seniority, prowess and affiliation. Seniority could sum up a thread running back into the first monuments, a desire to establish precedent and genealogical primacy, an urge to evoke the distant and the exotic, and sometimes the old, a compulsion to deal with the dead and the past, and a wish to be seen as innovative and creative. Prowess could evoke the ability to mobilise labour, the generosity to provide meat and other food in abundance, predicated probably on the capability to assemble and maintain large herds of cattle and other animals, and the capacity to defend oneself against the jealousies, predations and actual attacks of others.

Affiliation can speak for the provision of arenas to which people from far as well as near could be drawn, for the connections which brought in objects from distant sources, and for the fixing of these mixed identities in particular local places. It is important too to stress the opposites of these themes (cf. Barth 1987, chapter 9), to underline their importance. Thus assembly and aggregation imply dispersal and returning to much smaller groups; seniority incurs the risk of a lesser position; prowess carries the risk of limited success, scarcity or even failure; the killing of animals challenges their nurturing and accumulation as livestock; and affiliation may incur exclusions, enemies and violence. In the Bara mortuary domain, noted above, there are active concerns with notions of social order and vitality, and there are tensions between the two. Among components of order can be listed maleness, semen, bone, sterility and dying, and among the elements of vitality are femaleness, blood, flesh, fecundity and birth (Metcalf and Huntington 1991, 113–14). Maurice Bloch (1986; 1992) has also explored the inclusion of violence in acts of ritual which are otherwise seen to confer blessing and benefit to the participants.

This notion of opposites may help to outline some of the recurrent and dominant social and conceptual concerns of people in southern Britain from the late 38th century cal BC onwards. Can we go further? In the case of Windmill Hill, the character and distribution of finds within and around the three ditch circuits was taken to suggest the working through of a worldview or cosmology, with some kind of play between more abstract ideas of nature, the wild and the dead in the outer circuit and a more socialised world in the middle and inner circuits (Whittle *et al*. 1999). Contrasts have also been suggested between the different sides of Etton, and between circuit and interior (Pryor 1998); something similar has been mooted at Staines (P. Bradley 2004). Many of the elements of the Hambledon complex (e.g. Mercer and Healy 2008, 183–7, 337) could also be seen from this kind of cosmological perspective, in this instance with a more sacred core – or perhaps two cores – protected by a more profane exterior. There is no need, however, to insist that all such arenas had developed or recoverable cosmological schemes writ large upon them. It is entirely compatible with the notions of diversity and creativity discussed above that this should be an element more elaborated or more explicit in some sites than others, perhaps more often in the longer-lasting enclosures, though the dichotomy between the outer and inner ditches at both Abingdon and Maiden Castle can again be noted.

A more refined sense of timing and tempo should help our understanding of the scale of things, and we will concentrate here on deposition, connections and violence. The issue of feasting has already been raised, and the diversity of kinds of feasts and the scales of consumption is considerable (see above, and Dietler and Hayden 2001). Causewayed enclosures provide instances of both conspicuous consumption and acts of violence, so it may be legitimate to think of eating as in some cases a form of 'fighting with food'. That phrase derives from the study by Michael Young (1971) of Goodenough Island off the coast of New Guinea, where in a post-colonial setting instead of resorting to violence, people used competitive food exchange and festivals to shame enemies and offenders with gifts of pigs and yams. If this is too specific an analogy for fourth-millennium southern Britain, it is still important to be able to scale the nature of deposition, including food remains. Chapter 14.2 has stressed that the scale of deposition was often in fact quite modest. The most impressive deposits of cattle from Hambledon Hill come from slots cut into the largely silted main enclosure ditch, still within the primary use of the site, in the 34th century cal BC at the latest (Legge 2008); there are also impressive concentrations of material other than animal bones in the short-lived sites of Abingdon and Maiden Castle (Table 14.3), as well as at Whitesheet and Knap Hill. Nonetheless, it is rare for the primary levels of many causewayed enclosure ditches to be devoid of bone (as is, for example, normally the case with cursus ditches), as seen extensively in the large-scale excavations at Hambledon Hill and Etton (Legge 2008; Armour-Chelu 1998a), and even in the much more restricted 1988 excavations at Windmill Hill, confirming the wider pattern established by Keiller (Grigson 1999). That is not to require every ditch segment or every site to be the same; Offham and Combe Hill stand apart. But even if the remains of individual animals have been variously curated or exposed, and thereby dispersed, they nonetheless establish the recurrent killing of animals, normally cattle in the greatest numbers, a single beast of which could have provided meat for hundreds of people (Tresset 2000; Serjeantson 2006; Schulting 2008). So together the dating models and quantities of artefacts deposited provide perhaps on the one hand a relative sense of the frequency of visitation at enclosures through the 37th century cal BC and the first part of the 36th century cal BC, and on the other some indication of at least localised intensification of deposition towards the end of the use of enclosures.

Being connected was of central importance in the early Neolithic world. The Sussex mines were in use very early in the fourth millennium, their products reaching as far as Wessex and East Anglia, and other selected flints and continental jadeitites were also on the move well before enclosures (Figs 14.118 and 14.128). Chapter 14 has shown how the reach of exchange networks of south- and north-western stone axes extended during the first half of the 37th century cal BC (Fig. 14.140), more or less coinciding with the most active period of causewayed enclosure construction (Fig. 14.20). Those networks extended far to the east of the country, with Group VI axes at Etton and Haddenham, for example. The range of contacts visible through the phases of Hambledon Hill appears to extend with time (Chapter 4.1), though this trend cannot be traced as clearly at other sites. But it is striking that the axe networks are estimated in our models (e.g. Fig 14.144) to come to an end, or at least to decline substantially, *c.* 3500 cal BC, at the time when the construction of new enclosures had also come to an end. Axe sources like Langdale or Penmaenmawr

show profuse traces of workings on the ground, but the investigations of the former have suggested rather episodic and individually small-scale exploitations (Bradley and Edmonds 1993; Edmonds 1993b; 1995).

Being connected was not necessarily the same as being identical, and it is worth underlining again the appearance of both the South-Western style of pottery and Decorated pottery during the latter half of the 38th century cal BC (Fig. 14.142). The patterns are revealingly mixed. Roger Mercer has suggested a contrast between 'a focus to the west' and a 'focus to the east', with the latter enclosures showing 'similar overall enclosive design but perhaps rather different layout, little evidence of violence, less apparent functional variety and different exchange linkages' (2006a, 72). Yet the layouts can be grouped into a number of tendencies which need not be divided neatly into western and eastern (R. Palmer 1976a), and while there are some broad regional tendencies within Decorated pottery, Ros Cleal (1992) has stressed the individualistic and eclectic assemblages at individual enclosures. Perhaps affiliation can be seen as a flexible and opportunistic strategy.

There was probably at times good cause for this. If the early Neolithic world was in part competitive, as we have suggested, it was from time to time also violent, seen at both inter-personal and group scales (Fig. 15.22; see also Fig. 14.37). As already indicated in Chapter 14.2, the key issues are scale and timing. It is very difficult to infer the nature and scale of violence from the individual instances. It is likely that there would have been many more wounds or trauma than those that appear on the skeleton (M. Smith and Brickley 2009). Examples of cranial trauma could be the result of ritualised violence, such as the one-to-one clubbing known among the Yanomamo of Amazonia (Schulting and Wysocki 2005; Chagnon 1968). Certainly some cranial traumas show healing, victims or participants having survived (Schulting and Wysocki 2005; M. Smith and Brickley 2009). In other individual instances, such as Individual B2 from Ascott-under-Wychwood long barrow in the Cotswolds, death appears to have been caused by ambush with bow and arrow, leading to a swift and painful end (Galer 2007; Knüsel 2007), but it is impossible to say more about the wider circumstances of this event. Was this just one unfortunate victim, or the only victim from a greater number who was given special subsequent treatment? Or was this simply a hunting accident? There is little sign of violence at Windmill Hill but one of the individuals in the primary deposit of the West Kennet long barrow has a leaf arrowhead at the neck, and is a likely victim, so we can at least say that in the period across which Windmill Hill was constructed there was some local violence. In Wayland's Smithy I, three out of the 14 individuals in the primary mortuary deposit, which probably formed over a very short period of time, are associated with leaf-shaped arrowheads, one of them actually with a flint tip lodged in the bone; and it is possible given the brevity of formation of the deposit and the imbalance between 11 men, two women and a child, that this reflects some kind of collective killing or massacre (Whittle *et al*. 2007b). Studies in the American South-West have suggested that mortuary deposits following massacres or raids are often characterised by sex imbalance, with females taken off as captives or having escaped earlier as refugees (Lowell 2007). It is of course impossible reliably to extrapolate the scale of the violent encounter from the number of victims deposited in any one place, but a simple reading of the evidence might suggest an episode at Wayland's Smithy involving at least tens of people.

Episodes of collective violence were more prevalent in the west, and a large proportion of the evidence for individual trauma so far known from the period also occurs in the west (Fig. 14.37; also stressed by Mercer 2006a; 2006b). Is there any discernible chronological pattern? Episodes of collective violence appear to be spread throughout the middle of the fourth millennium cal BC (Fig. 14.36), in line with the currency of causewayed enclosures. There were burnings at Hembury in the 37th century cal BC, successive episodes at Hambledon from the later 37th to the mid-36th century cal BC, where Maiden Castle also belongs (it is possible that the attacks at Maiden Castle and in period 2 in the inner Stepleton outwork were precisely contemporary), and then the probably 35th-century event at Crickley Hill and the probably late episodes at Orsett and Carn Brea. The mortuary deposit at Wayland's Smithy I, which may also reflect a wider scale of violence, probably formed in the earlier 36th century cal BC. The instances of inter-personal violence cited range from the early part of the fourth millennium cal BC (at Coldrum), well before the appearance of causewayed enclosures, to the closing centuries of the millennium (at Millbarrow) (Fig. 14.36).

The evidence suggests that inter-personal violence occurred throughout the early Neolithic in southern Britain. Clearly, this kind of evidence has been underestimated in many past interpretations of the Neolithic, including beyond Britain, but within the literature that has redressed the balance (including Carman and Harding 1999; Christensen 2004; Parker Pearson and Thorpe 2005) there are dramatic accounts which incline towards an extreme picture of sustained communal conflict (e.g. Keeley 1996; Golitko and Keeley 2007), driven in part by unsettled climate, as already discussed with reference to the Michelsberg sequence (e.g. Gronenborn 2007b). In some ethnographic situations there are claims of up to a 30% fatality rate among adult males due to inter-personal violence (Chagnon 1988, 986). Keeley (1996, 39) has claimed that 'the great majority of non-state societies were at war at least once every few years and many times each generation' (1996, 33) and that 'peace was a scarcer commodity for members of bands, tribes, and chiefdoms than for the average citizen of a civilized state' (1996, 39). This raises issues over much wider areas than we can go into here; other studies suggest that Neolithic societies are less violent than later state-organised systems (Peter-Röcher 2007). The southern British evidence – and indeed that from the rest of Britain and Ireland – suggests that violence was mainly episodic and recurrent, reflecting endemic rivalry and temporary tensions, likely to break out at any time

between individuals, for all manner of prosaic and other reasons (among the Yanomamo, often starting because of sexual jealousies: Chagnon 1988, 986; see also Thorpe 2003). That characterisation may apply more widely, even back into the European Mesolithic, though among other instances in continental early Neolithic contexts we note the claim for the appearance of male archer-warriors in the early northern TRB (Brinch Petersen 2008). Perhaps we do not need to see different facets of early Neolithic sociality as fundamentally opposed. In wider terms, love and anger in one anthropological formulation very much go together (Overing and Passes 2000a; 2000b). People connected with others about whom they cared, in various senses of the word, but being thus connected and attentive to position and reputation, were also open to jealousy, competition and anger.

But with the appearance of causewayed enclosures in southern Britain and throughout their currency, came episodes of collective violence, on a bigger scale and of more dramatic character. The possible large-scale event reflected in the formation of the primary mortuary deposit at Wayland's Smithy I also belongs within this span. Is this because there is now a much larger sample of bigger archaeological sites, more extensively excavated, from which such evidence can emerge? Or did the practice of building and using causewayed and other enclosures go along with an increase in communal tensions, or indeed create them, as social networks intensified, more people who were not in regular contact were brought together, and desirables such as cattle and novel artefacts were assembled in perhaps greater quantities than ever before?

15.9 The hey-day of causewayed enclosures: a brief history

So now, having reviewed these general characterisations, and drawing on the sense of timing and tempo provided by the chronological models, we are in a position to sketch a brief but more site-specific narrative of the hey-day of causewayed enclosures in southern Britain and Ireland than was given in Chapter 14 (and see Fig. 15.23).

In Britain, things probably began quite slowly, in the east, in the late 38th century cal BC, like the first Neolithic practices some three centuries earlier (Table 15.2; Figs 14.15–16). The first enclosures were probably in the Greater Thames estuary, and perhaps for a generation or so Chalk Hill was either alone or one of very few sites of this kind in existence. The location is once again suggestive of the direction of continental links. The construction of Chalk Hill established the practice of large-scale, multiple circuits from the outset, and the tradition of abundant deposition in selected parts of the ditches, perhaps already the residue of more than just work party feasts (Dietler 1996; Schulting 2008, 107) but an extension of existing communal commensality. Kingsborough 2 may have followed, in the first generation or so of the 37th century cal BC, while Chalk Hill was still in use. There was clearly no rule book in operation, as its layout is simpler, and few artefacts were placed in the ditch (M. Allen *et al.* 2008, 244). Bury Hill in Sussex could fit in here (Fig. 5.31), its non-classic form also suggesting diversity in early layouts.

The pace began to quicken in the second quarter of the 37th century cal BC, with a scatter of sites along the south coast and its hinterland, like Whitehawk and Hembury, and possibly the first of the stone-walled tor enclosures in the far south-west (though their date estimates are imprecise), and the first of the enclosures in East Anglia, at Etton, and in Wessex, with the construction of the main enclosure at Hambledon Hill. Diversity also characterises this period, including some simple layouts such as Etton, though the initial plan at Hambledon was already on a considerable scale. It is possible that Hembury was built in anticipation of attack or at least attracted jealous attention very soon after it was constructed.

It is probable that relatively little time elapsed before the circuits at Whitehawk were multiplied, and further expansion took place at Hambledon Hill. These sites are far apart, but by the third quarter of the 37th century cal BC, other enclosures were appearing in coastal Essex, in Sussex, Wessex and now for the first time in the Cotswolds and the middle and upper Thames valley. So the gaps were closing, with more sites inland, and perhaps diversity and local aggrandisement were driven by emulation or at least awareness of others. Things were done differently in different places. The simple layout at Etton, for example, was kept going by recuts, and marked by unintensive deposition. An initially simple and small layout at Windmill Hill, however, was at the core of massive subsequent enlargement, each circuit probably following at an interval of a generation or so, with quite abundant deposition from the primary levels onwards. At Crickley Hill, either one circuit quickly followed another, or two were built more or less simultaneously. It was in this phase, probably between the 3640s and 3620s cal BC, that the primary use of some existing long barrows and long cairns came to an end, no longer perhaps – for one or other of the possible reasons discussed above – at the forefront, at least for the time being, of ritual attention. But we can note the continuation of the mainly eastern tradition of 'diverse and small' mortuary monuments, which had appeared at more or less the same time as enclosures themselves, or perhaps at the moment when enclosure construction was intensified (Fig. 14.142). Plenty of the evidence for inter-personal violence belongs to this period, but relatively little for larger encounters; the Hambledon Hill site phase 1b (second half of the 37th or the early 36th century cal BC) burning on the Shroton spur was probably extensive.

In the last quarter of the 37th century cal BC, enclosures appeared in south Wales and the Marches (Table 15.2), and the main overall distribution was established. There were limits to expansion northwards, in the southern Midlands, and the chronology of possible examples in north-east and north-west England and southern and eastern Scotland has yet to be established. At the turn of the century there appears to have been a lull in construction. The primary mortuary structure at Wayland's Smithy probably belongs

to the early part of the 36th century cal BC, with its primary barrow probably set up two to three generations later, and the first part of the 36th century cal BC saw renewed construction of new enclosures, leading to further spatial infill; examples include probably Knap Hill and Maiden Castle, and possibly Abingdon (if it belongs to the later peak of its bimodal distribution). There was continued activity at Hambledon Hill (if not already in the late 37th century cal BC), and the initial circuit at Crickley Hill was replaced by the construction of the single, much less interrupted ditch, probably following the digging of adjacent Peak Camp. Some of the biggest depositions were made in this period. The evidence for large violent encounters seems to be confined to the largest sites: at Hambledon Hill and possibly at Maiden Castle. The burning in the inner Stepleton outwork at Hambledon in site phase 2 (mid-36th century cal BC) was once more extensive, again possibly of a circuit raised in anticipation of attack, as in site phase 1b (Chapters 4 and 14).

By the time the construction of new enclosures in southern Britain was on the wane, from the middle of the 36th century cal BC, different histories were being established. Enclosures had been in primary use for varying durations, from a generation or less to a century or more. Now only certain sites continued in active use: Hambledon Hill once more; Windmill Hill; Crickley Hill; and Etton. At this point the history of southern British monuments becomes more complicated, with the continuation of those enclosures, the periodic construction of long cairns (and in the west perhaps portal dolmens/tombs), and the initiation of cursus monuments. Before we turn to these developments in more detail, we need to confront the implications of the now more detailed history of the hey-day of southern British causewayed enclosures. We have stressed their appearance at a certain point in the overall sequence, their gradual but ever-accelerating establishment over three to four generations, followed by a lull, which was succeeded in turn by another generation or two of fresh construction. Variation can be seen now through the lens of these temporal and spatial trends, and from the perspective of individual site biographies (Fig. 15.24). Generalisations about the nature and meanings of activity at causewayed enclosures can now be set within a much more specific history. Having hinted at the evidence for competition in the period before enclosures, and at emulation on the one hand and various kinds of conflict on the other within their main period of use, what language should we use to characterise the social relations of these southern British cattle-keeping communities whose fluctuating ceremonial fortunes we have documented? And how can we use a more detailed history of enclosures to explore the different practices elsewhere in Britain and Ireland at this time?

The scarcity of causewayed enclosures in Ireland must speak for a different process. Their construction began at least as early as in southern Britain. Both Magheraboy and Donegore are very familiar, in terms of both layout and the nature of deposition, compared with the wider repertoire of forms and practices seen both in southern Britain and on the European continent. The same general models of their social role as special places of labour and assembly could be applied to them as elsewhere, and they could readily be envisaged as fitting into landscapes otherwise marked by the movement of artefacts, and, at least for a while, by the presence of houses. In this sense, at least some people in Ireland were connected to much wider social networks, whether this was primarily with Britain or with points beyond on the continent. Yet the very scarcity of these enclosures in Ireland underlines marked difference in the uptake of practices and traditions much more firmly established elsewhere. It might only have taken a small number of lineages or communities, say, to have tried out the innovation of marking place and identity in this way, but unlike elsewhere, for example first in south-east England and then beyond, the idea did not apparently catch on or spread widely in the island context of Ireland on the evidence presently available. Other ways of thinking and doing things prevailed.

By the same token, it is worth reflecting again also on the scarcity of enclosures in Britain north of the Midlands, though that is not to exclude the possibility of outliers being confirmed in due course in northern England and Scotland (see again Fig. 1.2, and Chapter 1.3; Oswald *et al*. 2001). Here again there must have been different processes and ways of thinking. This contrasts sharply with the different distributions of for example Carinated Bowl and stone axeheads, and those of the wider long cairn and long barrow distribution. While for Ireland we might have recourse to a notion of insular identity, perhaps for northern England and Scotland another kind of explanation now emerges from this dating study. Could it be that enclosures were most favoured in those areas of southern Britain which had had or maintained the strongest links with the European continent, from initial colonisation to subsequent migration streams? It remains a puzzling contrast that the long cairn/long barrow distribution left no such clear-cut marker. This suggestion also provides a rather passive explanation of the difference seen in northern England. But on a more active note, could it also be that linear timber monuments in Scotland were a northern equivalent of enclosures in the south (Fig. 15.23),[11] and could they be seen as an assertion of some kind of regional identity?

15.10 Early Neolithic politics: ritual experts and organisers?

There is a tension between top-down and bottom-up accounts of social change. Top-down narratives tend to enforce static, predetermined models, smoothing out variation and ignoring gaps in the evidence, while bottom-up constructions risk remaining fragmented, incomplete and missing the 'big picture'. Neither has been very systematically applied to the early Neolithic context in southern Britain. The early Neolithic has in fact attracted less detailed attention in large-scale social evolutionary modelling than the late Neolithic. Classically, for example, the labour input required for long barrows and causewayed

Table 15.2. Posterior density estimates for the building of causewayed and tor enclosures in southern Britain and Ireland, derived from the models defined in Chapters 3–12 as detailed in the captions to Figs 14.2–4, and the models defined in Figs 14.1–4, 14.5 and 14.7–10 (see Fig. 14.13 for an illustration showing the archaeological difference between these estimates).

Area	**Region**	**Site**	**Comment/explanation**	**Distribution**	***Posterior density estimate* (*cal BC*) (*95% probability*) or calibrated date range (cal BC)(95% confidence)**	***Posterior density estimate* (*cal BC*) (*68% probability*) or calibrated date range (cal BC)(68% confidence)**
Southern Britain as a whole				Fig. 14.1: *start S British enclosures*	*3765–3695*	*3740–3705*
				Fig. 14.5: *start new S British enclosures*	*3750–3685*	*3730–3700*
				Fig. 14.7: *intensify building circuits*	*3715–3670*	*3705–3680*
SE England		State of enclosure building in area		Fig. 14.18: *start SE England*	*3795–3685*	*3750–3700*
	Greater Thames estuary	First enclosure in region		Fig. 14.15: *Thames estuary*	*3710–3665*	*3700–3670*
		St Osyth		Fig. 7.6: *start St Osyth*	*3660–3630* (*70%*) or *3565–3540* (*25%*)	*3655–3635* (*61%*) or *3555–3545* (*7%*)
		Orsett		Fig. 7.10: *start Orsett*	*4180–3380*	*3815–3385*
		Kingsborough 2		Fig. 7.17: *start Kingsborough 2*	*3790–3630* (*76%*) or *3615–3535* (*19%*)	*3710–3635* (*61%*) or *3565–3545* (*7%*)
		Kingsborough 1		Fig. 7.15: *start Kingsborough 1*	*3780–3520*	*3660–3580*
		Chalk Hill		Fig. 7.21: *start Chalk Hill*	*3780–3680*	*3740–3690*
	Sussex	First enclosure in region		Fig. 14.15: *Sussex*	*3705–3650*	*3690–3660*
		Whitehawk		Fig. 5.5: *build Whitehawk*	*3690–3635* (*73%*) or *3620–3560* (*22%*)	*3675–3635* (*67%*) or *3595–3585* (*1%*)
		Offham Hill		Fig. 5.14: *burial 1*	*3635–3555* (*66%*) or *3540–3490* (*23%*) or *3435–3380* (*6%*)	*3630–3585* (*56%*) or *3525–3505* (*12%*)
		Combe Hill	*Terminus ante quem* for inner ditch	Table 5.4: I-11613	3640–3010	3510–3110
		The Trundle	*Terminus post quem* for inner ditch)	Table 5.5: I-11614	3900–3370	3710–3520
			Terminus post quem for ditch 2	Table 5.5: OxA-14024	3650–3520	3640–3530
			Terminus post quem for spiral ditch	Table 5.5: I-11612	3940–3370	3710–3530
		Bury Hill		Fig. 5.31: *build Bury Hill*	*3775–3650*	*3760–3740* (*7%*) or *3715–3660* (*61%*)
		Court Hill		Fig. 5.28: *build Court Hill*	*3650–3530*	*3640–3620* (*19%*) or *3605–3550* (*49%*)
South-central England		Start of enclosure building in area		Fig. 14.18: *start central S England*	*3735–3645*	*3695–3655*
	South Wessex	First enclosure in region		Fig. 14.15: *south Wessex*	*3680–3640*	*3665–3645*
		Hambledon Hill		Fig. 4.7: *build main enclosure*	*3675–3630*	*3660–3640*
				Fig. 4.11: *build Stepleton enclosure*	*3640–3565*	*3640–3615* (*42%*) or *3610–3585* (*26%*)

Area	Region	Site	Comment/explanation	Distribution	***Posterior density estimate* (*cal BC*) (*95% probability*) or calibrated date range (cal BC)(95% confidence)**	***Posterior density estimate* (*cal BC*) (*68% probability*) or calibrated date range (cal BC)(68% confidence)**
		Whitesheet Hill		Fig. 4.26: *build Whitesheet Hill*	*3655–3630* (*10%*) or *3610–3535* (*85%*)	*3595–3550*
		Maiden Castle		Fig. 4.41: *start Maiden enclosure*	*3580–3535*	*3560–3540*
		Robin Hood's Ball		Fig. 4.51: *build Robin Hood's Ball*	*3640–3500* (*91%*) or *3430–3400* (*4%*)	*3635–3570*
	North Wiltshire	First enclosure in region		Fig. 14.15: *north Wiltshire*	*3685–3640*	*3670–3645*
		Windmill Hill		Fig. 3.15: s*tart Windmill Hill*	*3700–3640*	*3680–3650*
		Knap Hill		Fig. 3.25: *start Knap Hill*	*3765–3500* (*78%*) or *3485–3380* (*17%*)	*3660–3515* (*63%*) or *3435–3415* (*5%*)
	Eastern England	First enclosure in region		Fig. 14.15: *eastern England*	*3705–3650*	*3695–3660*
		Northborough		Fig. 6.39: *start Northborough*	*3700–3550*	*3645–3585*
		Etton Woodgate		Fig. 6.36: *build Woodgate*	*3645–3525*	*3640–3620* (*16%*) or *3605–3540* (*52%*)
		Etton		Fig. 6.33: *build Etton*	*3710–3645*	*3705–3670* (*63%*) or *3665–3655* (*5%*)
		Briar Hill		Fig. 6.21: *build Briar Hill*	*4170–3355*	*3745–3415*
		Haddenham		Fig. 6.11: *start Haddenham*	*3960–3125*	*3725–3365*
		Maiden Bower		Fig. 6.4: *start Maiden Bower*	*3775–3380*	*3660–3590* (*23%*) or *3555–3505* (*17%*) or *3475–3395* (*28%*)
	Thames valley	First enclosure in region		Fig. 14.15: *Thames valley*	*3700–3605* (*92%*) or *3585–3565* (*2%*) or *3560–3540* (*1%*)	*3660–3630*
		Abingdon		Fig. 8.22: *start Abingdon*	*3670–3630* (*55%*) or *3585–3570* (*3%*) or *3565–3535* (*37%*)	*3655–3635* (*42%*) or *3550–3540* (*26%*)
		Gatehampton Farm	*Terminus post quem* for enclosure ditch	Table 8.4: GrA-31358	3760–3630	3710–3640
		Eton Wick		Fig. 8.5: *start Eton Wick*	*3720–3420* (*94%*) or *3395–3365* (*1%*)	*3560–3455*
		Staines		Fig. 8.3: *start Staines*	*3710–3400*	*3645–3600* (*15%*) or *3570–3425* (*53%*)
	Cotswolds	First enclosure in region		Fig. 14.15: *Cotswolds*	*3680–3615*	*3660–3630*
		Crickley Hill		Fig. 9.7: *start Crickley Hill*	*3705–3600*	*3670–3620*
		Peak Camp		Fig. 9.19: *start Peak Camp*	*3860–3555*	*3730–3585*

Area	**Region**	**Site**	**Comment/explanation**	**Distribution**	***Posterior density estimate (cal BC) (95% probability)* or calibrated date range (cal BC)(95% confidence)**	***Posterior density estimate (cal BC) (68% probability)* or calibrated date range (cal BC)(68% confidence)**
South-west Britain	South-west peninsula	Start of enclosure building in region		Fig. 14.18: *start SW peninsula*	*4020–3660*	*3780–3675*
		First enclosure in region		Fig. 14.15: *south-west peninsula*	*3705–3650*	*3695–3660*
		Hembury		Fig. 10.9: *start Hembury*	*3730–3650*	*3705–3665*
		Raddon		Fig. 10.16: *start Raddon*	*3820–3530*	*3700–3625 (42%)* or *3615–3550 (26%)*
		Helman Tor		Fig. 10.22: *start Helman Tor*	*3845–3650*	*3750–3665*
		Start Carn Brea		Fig. 10.25: *start Carn Brea*	*4040–3530*	*3755–3560*
	South Wales and the Marches	First enclosure in region		Fig. 14.15: *S Wales & the Marches*	*3645–3550*	*3640–3580*
		Hill Croft Field		Fig. 11.3: *build Hill Croft Field*	*3640–3500 (92%)* or *3415–3380 (3%)*	*3635–3620 (9%)* or *3605–3520 (59%)*
		Banc Du		Fig. 11.8: *build Banc Du*	*3645–3490 (84%)* or *3470–3400 (11%)*	*3640–3620 (7%)* or *3610–3515 (61%)*
Ireland		Donegore		Fig. 12.5: *start Donegore*	*3855–3665*	*3780–3685*
		Magheraboy		Fig. 12.15: *start Magheraboy*	*4115–3850*	*4065–3945*

enclosures was seen mainly as a foil for the much greater investments made in henges, Stonehenge and Silbury Hill (Renfrew 1973b). There have been one or two half-hearted attempts to evoke 'proto-chiefdoms' in the early Neolithic (e.g. Renfrew 1973b; compare Darvill 1979; and Ebbesen 2007, 48–50; Earle 1997), but none of the 20 criteria listed by Renfrew (1973b) – from 'ranked society' and 'redistribution of produce organized by the chief', 'a greater number of socioeconomic statuses', and 'pervasive inequality of persons or groups associated with permanent leadership', to 'more clearly defined territorial boundaries or borders', 'reduction of internal strife' and 'rise of priesthood' – seem obviously to apply to the early Neolithic situation in southern Britain. Nor does the 'organization and deployment of public labour' associated with large-scale schemes like irrigation works or the building of temples, temple mounds or pyramids, seem appropriate for early Neolithic times.

So is it largely a matter of more boldly applying more detailed evolutionary models? But which ones? Once we move from broad distinctions between Mesolithic and Neolithic 'modes of thought' based around contrasting attitudes to sharing versus accumulation, followership versus leadership, universal kin classification versus distinctions between kin and non-kin, and the land as sacrosanct versus people as sacrosanct (Barnard 2007; Helms 2007), what explanations should we adopt? And is this kind of distinction anyway sufficiently precise to encompass diversity among both hunter-gatherers and agriculturalists?

The notion of 'transegalitarian' societies has been applied to both complex hunter-gatherers and simple horticulturalists, as well as pastoral nomads:

> The term refers to societies that have characteristics intermediary between egalitarian bands at one end (with minimal private ownership and widespread sharing) and stratified chiefdoms at the other end. Transegalitarian societies therefore have ownership over resources and products, they have prestige goods and socioeconomic inequalities, but they lack the political stratification characteristic of true chiefdoms (B. Hayden 2009, 31).

Leaving aside the question of what a 'true' chiefdom may be (given that this is another area with immense variation: Drennan 1996; McIntosh 1999; cf. Pauketat 2007), this still leaves open an enormous amount of diversity. One tactic therefore might be to evoke more precise analogies within this broad evolutionary perspective (cf. R. Chapman 2008). For example, the distinction has been made in Melanesian ethnography between 'great men' and 'big men' (Godelier and Strathern 1991). Both are socially pre-eminent, but great men achieve this by involvement in restricted exchanges and ritual complexity, while big men are often seen as entrepreneurs, engaged in unequal or non-equivalent exchanges and not averse to warfare and violence; it is often supposed that, historically, big men systems emerged out of great men systems (Lemonnier 1991). Pierre Lemonnier

Fig. 15.24. The court tombs at Ballybriest, Co. Derry and Goward, Co. Down (above, left and right), and the portal tombs at Wateresk, Co. Down, and Gaulstown, Co. Waterford (below, left and right), Ireland. Photos: Vicki Cummings.

(1991) has discussed the relationship between warfare and large-scale ceremonial exchanges as two complementary forms of competition in which big men have a central role. Big men, if they do not actually start wars, are active and prominent in them, and exploit their consequences for their own advantage. They are crucial in peace-making, using talents for oratory, their connections and wealth to stop fighting and to organise compensation payments through ceremonial, non-equivalent (wealth for life) exchange (Lemonnier 1991, 8–11). So could we be thinking along these sorts of lines for the southern British case of the 37th to 36th centuries cal BC, with more dynamic organisers than simply the 'ritual experts' who guided initiation rituals among the small Ok communities of mountain New Guinea (Barth 1987)? Would this not bring alive in the southern British case the possibility of already genealogically senior people, competitive and restless, keen to innovate, to accumulate including by raiding and wider warfare if need be, but able also to make and temporarily keep the peace by holding large-scale gatherings and feasts? The accelerated or more concentrated timescales for enclosure construction which this study has presented would certainly be compatible with this kind of political manoeuvring.

But the problem of variation will not go away. Lemonnier himself cites (1991, 11–12) warfare and ensuing compensations in societies without big men. Polly Wiessner (2002) has emphasised, also using evidence from highland New Guinea, among the Enga, the capacity of egalitarian ideology and structures to curb the actions and scope of 'aggrandizers', through an ideology promoting access to resources, exchange with partners outside the clan, and the independence of segmentary lineages. So how could we be sure that causewayed enclosures are to do with organisers and aggrandisers in the first place?

If this approach seems doomed to chase from one kind of analogy to another, to be lost in an uncertain sea of variation, the bottom-up school appears largely to have avoided the problem altogether. The more recent literature on monuments has been much less explicit about social relations, concentrating on other themes such as experience, landscape setting, transformation and movement, and particularly at the scale of individual sites. But perhaps because of their more constrained features, long barrows and long cairns – and court tombs and portal tombs in Ireland – have continued to attract specific discussion in terms of families, kin groups, lineages and so on (e.g. J. Thomas 1987; Saville 1990; A. Powell 2005; Benson and Whittle 2007; M. Smith and Brickley 2009). Few of the many recent discussions of causewayed enclosures, however, have been explicit about the wider social relations involved in the many activities represented, though Roger Mercer (2006a, 74; 2008a), writing of western enclosures, has hinted at 'quasi-political prominence for some sites as 'symbolic' of the social solidarity that they had come to represent'.

Could the detailed timetables offered here not re-energise this task? They provide sequence, in the broadening from barrow and cairn construction to the building of enclosures, and in the shifting, often unstable biographies of individual examples of those arenas. This was a history in the making, rather than the inevitable arrival of types or stages, in which the decision to undertake and perform an enclosure was nowhere a foregone conclusion; southern Dorset, for example, only witnessed such an event right at the end of the period when causewayed enclosures were established, and large parts of the country were never to do so. Suppose, for example – though plenty of other scenarios could also apply – that some kind of 'big man' or 'great man' emerged in the area of Hambledon in the 3660s cal BC who believed in the power and reputation of enclosure. His descendants continued, periodically, with this practice, but his contemporaries in southern Dorset, and their descendants, did not, until, belatedly, and after the lull in constructions around the turn of the century brought on perhaps by general exhaustion, one of them decided to rejoin what was by now an old bandwagon…

Enclosures were preceded (and overlapped) by smaller monuments capable of being built by perhaps some 10,000 hours of labour, and which were normally to hold the remains of not more than 40 people, deposited over one to three–five generations. Using a 50-year span of primary use over a period of 200 years, there might have been 29 such monuments in contemporary use in the area of the Cotswolds. This probably does not speak for overall social hierarchy, though it could evoke a striving for seniority and local pre-eminence, as monument after monument was set up and used, as people creatively worked and reworked the architectural repertoire, and perhaps thought through a variety of descent modes. Kinds of descent are much more actively discussed for other parts of the Neolithic, for example the LBK. For that there is currently a dominant model of patrilocality and patrilineal descent (e.g. Eisenhauer 2003), though much more open arrangements than bounded corporate groups, including kindreds of bilateral descent, have also been mooted (Milisauskas 1986, 218; Whittle 2009, 254). Andrew Powell (2005, 22) has suggested that the architecture of court tombs and portal tombs projected 'idealized and formalized representations' of kinship and other local social relations, such that 'an ordered version of past kinship relations was distilled out of the complex web of descent and alliance, fusion and fission, of which the corporation constructing the tomb was the product, in order to portray its past in a way that legitimized the present'; architectural symmetries served to balance and control the past. Could the southern British case not also be characterised by diversity, with potentially strong contrasts between those mortuary architectures which emphasise opposition or difference (such as lateral chambered tombs), those which stress singularity (such as terminal chambered cairns), and those which effect complementarity (such as transepted chambered cairns)? Were these more prominent and contested issues among people living in central and western southern Britain?

But could we not see more in the architecture, both in its compartmentalisation and in its layout? Lateral chambered tombs in particular, with their careful symmetries and

oppositions strongly suggest the possibility of separate descent groups. And were this so, it is striking that bilateral descent can be associated with short chains of social memory, which dissipate after three to four generations in a meshwork of complex relationships (Foxhall 1995; Forbes 2007, 136–41). This resonates with the short durations of the primary use of at least some southern British long barrows (Bayliss and Whittle 2007).[12] We do not need to force everything into the same mould, but could an idea of bilateral descent have been a dominant early trope in the domain of descent, to be succeeded or overlapped by the emergence of unilineal systems with longer chains of social memory? Is this succession expressed in the emergence of enclosures, the initial use of some of which persisted for 12 or more generations rather than the few generations of some long barrows and cairns? And does the reference to an older past argued for the architecture of Wayland's Smithy II probably in the second half of the 35th century cal BC (Whittle *et al*. 2007b, fig. 4) belong to this same kind of scenario?

The situation changes with the introduction of enclosures. We have discussed three scenarios, two specific and one general: the management of cattle; the elaboration of funerary or commemorative rites for the dead; and a general widening of social interaction as dispersed communities became more established. The very idea of enacting a version of the continental idea of enclosures may speak for the continuance of the urge for seniority and prominence. We might think in very broad terms for the very first enclosures of the kind of ritual experts described by Fredrik Barth (1987) in *Cosmologies in the making*, though thereafter, as the number of eye witnesses must have multiplied, it can hardly have been inherently secret knowledge that controlled the setting up of new enclosures; someone born in central southern England in say the 3680s cal BC could, if their life stretched to seven decades, have seen the building of as many as six enclosures, all within a few days' walking distance, say 75 km. In this regard, enclosures are ambiguous, since they may have created an opening or broadening of participation compared with the hidden worlds of barrow and cairn interiors, while at the same time presumably requiring organisers or promoters to galvanise or provoke action – and who knows if that still required the possession of secret knowledge? The elaboration of some sites may have been due to a desire both to emulate previous generations of builders and to out-do contemporaries in terms of what could be conceived possible.

There are other tensions. The mobilisation of labour is of key importance. With shortened timescales, and the 100-people model, the diversion of energy from other routine tasks is probably significantly less than previously envisaged in the literature, and any one episode of enclosure construction can be further broken down into individual circuits (as appropriate) and individual segments. As discussed above, it is not so much that construction was an endlessly ongoing project, but more that it was one that belonged to and required very specific, short-lived circumstances. To attract even a modest workforce over successive years for a single task of this kind might have required a balance between the persuasive powers of organisers and the communal will. Different participants may have sought or expected different rewards. The possibilities could evoke various of the ethnographic analogies already noted, from the big men whose action and reputation serve their community (Lemonnier 1991), to the communal brake on aggrandisers (Wiessner 2002). The general fragility and brevity of these comings together should perhaps be stressed the most. That these mobilisations took place from time to time and from place to place speaks for changing circumstances in the 37th and 36th centuries cal BC, but those eight generations probably saw not the establishment of more clearly demarcated power relations, but a shifting jostling for position within a historically derived idiom, open to individual or interest-group manipulation perhaps, but constantly subject to public or communal view and sanction. People who freely donated their labour could also walk away without constraint. A successful enclosure required not just labour but witnesses and participants, the largest assemblies perhaps attracting hundreds of people; gatherings can also quickly break up and disperse. Perhaps some of the violence seen at and around enclosures (principally more to the west than to the east) comes from internal dissension, *within* the constituencies of participants, rather than from external enemies, especially at or very soon after episodes of construction. Why were people in the west apparently more inclined to violence than those in the east?

The indications from ethnography are that people fight as much over such things as sex, gambling and reputation (Chagnon 1988; Thorpe 2003) as directly over resources. If cattle and ground stone axes were objects of desire in the early Neolithic, were these also the focus of competition? Are cattle and axes in a sense the cause as well as the symptom of causewayed enclosures? Although we have outlined new patterns in the chronological development of axe movements, we know so little of either sphere that it is unwise to be dogmatic. We know virtually nothing of rules and practices of ownership of cattle in the early Neolithic. Did particular families, kin groups or lineages accumulate the largest herds, and had this process begun before enclosures came to be built? We have already noted the slender clues of the cattle skull under the Ascott-under-Wychwood long barrow, probably of the 38th century cal BC, and the cattle skull in the final deposits at Fussell's Lodge, probably deposited in the 3650s or 3640s cal BC (Wysocki *et al.* 2007, fig. 10). Did the final arrangements at Fussell's Lodge suggest some kind of equivalence between selected, composite persons, decorated pottery and cattle? If two or three beasts could feed hundreds, perhaps any family or small group possessing cattle could potentially have laid on a feast, or contributed to one; the impression from the Hambledon cattle bones was of selected animals taken to the hill for slaughter (Legge 2008). The relative costs or consequences, however, must have varied depending on the size of herds, and possessors of more animals would certainly be at an advantage in competitive and recurrent

circumstances. The incentives to raid cattle also come to mind (Schulting 2004). But if such conditions were widespread right across southern Britain – and cattle are encountered at Chalk Hill, Etton, Northborough and elsewhere in the east – we might expect more signs of inter-group violence in the east as well as in the west. So, were cattle more central to Neolithic subsistence strategies in western Britain than in the south-east? Or perhaps, the diverse, small monuments mainly of the east might speak for a less complicated descent world there, perhaps even the establishment of local social hierarchies, as seen in the contrasts between say West Kennet and Fussell's Lodge long barrows and the Whiteleaf oval barrow. Or again, even the older history of eastern connection with the European continent and the energy devoted in the west to building and bickering may be to do as much with matters of seniority and reputation as with straightforward measures of ownership and possession.

15.11 Elsewhere

If there are no easy labels for social developments in southern Britain from the 38th into the 37th and first half of the 36th centuries cal BC, their special character can be underlined by consideration of elsewhere in Britain and Ireland at these times (Figs 15.24–7).

We have already noted Richard Bradley's (2007) underlining of differences at a large scale between Britain and Ireland as wholes, which serve to relate the varying treatments of the body in death, by inhumation and cremation respectively, to the nature of residence in life, in house-poor and house-rich situations. In more detail, Chris Fowler (2001, 158; 2004b, 100) has referred to the variety of discourses about issues of identity, the body and death around the country as a whole. So were there absolute differences between southern Britain and the rest of Britain and Ireland, or equivalences despite differences in form, or just endless diversity from place to place and region to region?

It seems important to avoid any simple or absolute contrast between areas with and areas without enclosures. On the one hand, there are two proven examples in Ireland, and other potential candidates (Chapter 12), as there are also in north-east and north-west England, and southern and perhaps eastern Scotland. On the other hand, there are parts of southern Britain where enclosures were relatively rare, as in East Anglia east of the Fens. The late date and brief life of the Maiden Castle enclosure remind us, once again, that even *within* the main distribution of causewayed enclosures there were absences for much of their period of popularity. And not all southern enclosures were the same. There was also much else in common across Britain and Ireland, unsurprisingly given the processes argued above, including clearance sequences in pollen diagrams (e.g. K. Edwards 2004; Tipping *et al.* 2009), the use of cereals and domesticates, Bowl pottery, leaf arrowheads and polished stone axes, some other aspects of lithic technology, the building of rectangular timber houses, pit digging, and the construction of megalithic and non-megalithic mortuary structures. Linear monuments are found in Scotland, though claims for their very early dating are not securely based on short-life samples unequivocally associated with their construction and use, and they need in fact be no earlier in the north than in the south, in the present state of the evidence (Figs 14.44 and 14.170).

There are very few features which stand out as absolutely separate regional traits. Fields in western Ireland might be one candidate, alongside the predominantly southern British causewayed enclosures. Elsewhere it seems to be a question of overlap and difference of degree, with regional interaction persistently important (e.g. Cooney 2000a; G. Barclay 2004; Noble 2006; Waddington 1999; Passmore and Waddington forthcoming; Brophy and Barclay 2009). The distribution of the mainly Irish and western portal tombs or dolmens, for example, extends into the Cotswolds (Darvill 2004a); court tombs in Ireland overlap in style with western Scottish Clyde cairns, though regional styles can of course be found in the Hebrides and the Orkneys, and elsewhere. Likewise there are early regional variations within the Scottish Carinated Bowl tradition (see Chapter 14.7), but it is noticeable that the Carinated Bowl style probably comes to an end in Scotland soon after 3600 cal BC, not much later than the date of the more general end of that tradition further south, *c.* 3650 cal BC (Figs 14.88 and 14.158). And while the plethora of new sites in eastern Scotland, as outside Aberdeen and on the A1 east of Edinburgh (Cook and Dunbar 2008; Lelong and MacGregor 2007), serves to show that there is more to the Scottish early Neolithic sequence than what was earlier found on Orkney (G. Barclay 2004; Warren 2004), the Bowl pottery, pits, pyres and trapezoidal mounds do not seem wholly alien to or removed from features and practices in parts of eastern England.

What then are we to do with this rather blurred sense of both similarity and difference? We are not proficient with questions of either space or time. Using the boundaries of modern countries as cultural yardsticks is far too crude; any smaller scale for regions, although often implied, is normally poorly defined; but to refer everything to purely local agency, however, also seems inadequate. We are hampered, secondly, by inadequate chronologies. We can say little in detail, from the evidence reviewed in this volume, about the development of portal and court tombs in Ireland, or Clyde cairns in Scotland. So while we have been able to suggest a new view of the date of – and processes behind – the introduction of Neolithic things and practices in Ireland, Mann and Scotland, it remains very hard to follow subsequent developments in any detail. Did court tombs and Clyde cairns come with a rush in the 38th century cal BC, for example? Ballyglass follows the house underneath it, probably not earlier than the middle of the 37th century cal BC, but other specific clues like this are rare. At this stage we simply do not know, and we are back to fuzzy prehistory, which makes the more precise interpretations which we have sought in southern Britain more or less impossible, and comparisons between

Fig. 15.25. Eagle's Nest, Lambay Island, Co. Dublin. Excavation of porphyry (porphyritic andesite) for axehead production. Section shows build-up of porphyry debitage dating to the Early Neolithic; the quarried face is to the left of the photograph with a propped anvil stone in front of it. Photo: Gabriel Cooney.

the south and elsewhere for the time being extremely problematic.

One feature has been much better dated elsewhere: houses. Large timber halls were found in southern and eastern Scotland in the 38th century cal BC (Fig. 15.26); the longest-lasting example so far known, at Balbridie, persisted into the 37th century cal BC, as did the one constructed later at Claish (Fig. 14.174). In Ireland, rectangular houses were in use for a century or so, or less than a century, from the late 38th century cal BC into the later 37th century cal BC (Figs 12.22 and 12.28–9). In model 3 of Chapter 12, they belong a little after first beginnings, whereas in model 2 they follow closely on the start of the Neolithic. The Irish situation following model 3 is more in line with our current understanding of the situation in Scotland. As noted in section 15.2, models 2 and 3 cannot both be right, and our inclination was to favour model 3. So this possible framework gives interesting choices. It is difficult to argue that all houses are in some way the equivalent of enclosures, as implied for example by Sarah Cross (2003), since the Scottish halls probably precede the southern British causewayed enclosures, but they and at least some of the Irish rectangular houses could have been the venue for significant social gatherings, with feasting not excluded (though no compelling such animal bone assemblage has yet been published from a house site). What can be asserted if we follow model 3 is that, whereas in southern Britain, after a longer history of early Neolithic activity, communities went on to the more complex and at times extravagant activities seen at enclosures, in Ireland, relatively earlier in the sequence, sociality was focused on the house. The same may apply to the middle of England, on the basis of the dates from Lismore Fields, Derbyshire, and to north Wales, on the basis of dates from Llandygai. Further, the period of both phenomena was relatively brief, the heyday of southern enclosures lasting some eight generations, and that of Irish houses four or fewer. When creative innovation went on to produce cursus monuments in southern Britain, did attention shift in Ireland and Scotland to monumentalisation of a variety of tombs (Figs 15.24 and 15.27)? Is the relationship shown at Ballyglass, with court tomb overlying a dismantled rectangular house, typical of wider areas, and what interval was there between the two constructions there? Perhaps, as time went on, references to the past multiplied as much as practices in the present.

Of particular interest for the future would be more information from the area immediately to the north of the main distribution of southern British causewayed enclosures. How far north did one have to go, from well established and long-lived enclosure complexes like Crickley Hill/Peak Camp and Etton and its neighbours, before a different

Fig. 15.26. The timber hall at Warren Field, Crathes, Aberdeenshire, Scotland, under excavation. Photo: Murray Archaeological Services Ltd.

style of living was encountered? Rather than more abstract shufflings of the pack of regional diversities, concentrated research here could contribute much to our understanding of scales of social interaction.

15.12 Later histories: the pace and character of change

There came a time when a new kind of monument altogether came to be built: the cursus monument. Some of these appear directly to overlie causewayed enclosures, for example at the unexcavated Fornham All Saints (see again Fig. 15.20) and the excavated Etton examples. The date estimate for the end of the Etton causewayed enclosure lies in the later fourth millennium cal BC (Fig. 6.33). The long mound at Maiden Castle, whose linearity can surely be linked to the idea of cursus monuments and which also directly overlies the western circumference of the causewayed enclosure, is a little more precisely dated, belonging probably to the late 36th or 35th century cal BC (Fig. 4.56). The date estimate for the Dorset cursus is far from precise (Figs 4.19 and 4.58). The earliest examples are probably Stonehenge and Drayton (Fig. 14.185); locally, the greater Stonehenge cursus would follow Robin Hood's Ball, and depending on which of its peaks Abingdon falls, Drayton could follow or precede Abingdon (Chapter 8.6). Both events could fall in the mid-36th century cal BC, more or less coinciding with the end of the main period when causewayed enclosures were established.

So, causewayed enclosures flourished as the novel focus of large-scale, ceremonial activity for some eight generations, the success of the probably public performances waxing and waning through this timescape – with one pronounced lull in fresh construction and considerable variability from locality to locality. We have argued that the milieu was probably in various ways competitive, and possible signs of impressive but short-lived enclosure constructions and attendant assemblies may be a further clue to the nature of interaction in the mid-36th century cal BC. We know so little of cursus monuments that it is pointless to espouse any single interpretation, but the many existing views (see amongst others: Tilley 1994; C. Richards 1996; Barclay and Harding 1999; A. Barclay *et al.* 2003; Loveday 2006; J. Thomas 2007b; R. Bradley 2007) can all now be put into the preliminary outline of a more specific historical context. Whatever the precise circumstances, it is not difficult to envisage the creativity represented by cursus monuments (see again Barth 1987) as a product of continuing desire for innovation and difference. Thus, linearity now succeeds circularity, and movement and direction now rival activity in a single fixed spot. Though labour inputs may in many cases not have increased substantially, the new visual impact of cursus monuments was potentially stunning, and the experience of procession inside, outside

Fig. 15.27. Clyde cairns at Cairnholy, Dumfries and Galloway, Ardnadam, Argyll and Bute (above, left and right), Blasthill (Kintyre), Argyll and Bute, and Loch Nell, Argyll and Bute (below, left and right). Photos: Vicki Cummings.

or alongside these perhaps awe-inspiring, liminal places did away with or surpassed previous feasting and deposition in causewayed enclosures. Perhaps there were deliberately more arcane ideas at work now, with orientations and cosmological aspects possibly a significant dimension, with the setting, speculatively, a forum for the elaboration of abstract or more secret concepts of the past, ancestors, spirits, natural forces and the like: more easily controlled, and less open to direct contestation and rivalry than in the open and public arenas of causewayed enclosures. It was probably no accident that long barrows were incorporated into the Dorset cursus, or that one stands at the east end of the greater Stonehenge cursus.

The sequences now partially visible indicate, however, that this was no straightforward replacement, just as earlier causewayed enclosures were added to a repertoire of existing monumental constructions. This time, there is no evidence to suggest derivation from continental practice (though linear monuments did exist much earlier in northern France: Kinnes 1999). It has been suggested that this was an idea first developed in Scotland (e.g. J. Thomas 2006), but the vast majority of dates from Scottish linear monuments are on potentially old wood; those that are not give no clear primacy to northern development (Chapter 14.7). There is limited evidence for comparable monuments in Ireland, though for example there appears to be one to the east of and close to Newgrange (Smyth 2009). So at this stage it is impossible to see where the cursus idea first developed, or how quickly it was introduced, and if this was indeed an elaboration of, and in some kind of opposition to, causewayed enclosures, the first moves might just as well have been made in southern Britain. Indeed, eastern England provides a small number of possible antecedents in the form of rectilinear and elongated monuments which are poor in or devoid of cultural material, like cursus monuments and in comparable low-lying river valley locations to cursus monuments. Where these can be approximately dated, like the avenue at Raunds or the trapezoid enclosure at Godmanchester, they go back to the early or mid-fourth millennium cal BC. It is surely significant that a cursus was *appended* to the Godmanchester trapezoid enclosure, extending its original alignment, while two others were built *cutting across* the Etton and Fornham All Saints causewayed enclosures, as if superseding them (Chapter 6). It is noticeable that farther west in the upper Thames valley, with its numerous causewayed enclosures, there are also cursus monuments in numbers.

A perhaps more differentiated social landscape now came into being in southern Britain. If seniority was an important principle in earlier times, did cursus monuments come to subvert that from the mid-36th century cal BC onwards? Are we witnessing an increase simply in inter-group competition, or is there something more subtle by way of rivalry between say senior and junior clans or

lineages? Alongside novel linear monuments, some of the old places of assembly continued in existence, and there was renewed conflict seen in the dramatic event of the battle of Crickley Hill in the 35th century cal BC (Fig. 9.20). Other old ways of doing things were still practised from time to time and place to place. Wayland's Smithy II probably also belongs to the 35th century cal BC (Whittle *et al.* 2007b, fig. 4), and Millbarrow probably even later (Fig. 3.30). Both use an architectural form which had been in favour at least two centuries earlier (Fig. 14.45), and could evoke a conscious archaising; neither is in an area with cursus monuments in the immediate vicinity, the downland edge close to Wayland's looking down on the Vale of the White Horse and the upper Thames valley beyond where linear constructions were probably by now a frequent sight, and Millbarrow out on the poorly known but perhaps little inhabited Lower Chalk north of Windmill Hill, with only the north face of the old enclosure in view; the stone avenues of the region were probably yet to be built (Gillings *et al.* 2008). There are further unanswered questions in the later history of long barrows. Few individual sites appear to have had a very long history of active use, though the rebuilding of Wayland's Smithy, and the start of secondary deposition in the chambers at West Kennet (Whittle *et al.* 2007b; Bayliss *et al.* 2007b), are counter-examples. And yet the tradition, indeed to some extent also like that of diverse and small monuments, persisted for a very long time. Did principles of descent endure more easily than the concerns of more public and political ritual?

Those causewayed enclosures still in use probably came to the end of their primary use at the end of the 34th century cal BC (Fig. 14.145). What continued at this point in southern Britain is unclear, and is getting beyond the reach of the present project, though it seems that no henges were yet constructed in the south. But it is striking how other things and practices come to an end from around this kind of date (Fig. 14.145), so there is every reason to suppose that change continued, even though the dynamics of the late fourth millennium have yet to be revealed. Further afield, there are also signs of ongoing change, for example in the further development of single burials in eastern parts of the country, as seen at Duggleby Howe in Yorkshire (Gibson and Bayliss 2009), and in the development of passage tombs in Ireland, but it is too soon to say whether these later-fourth millennium shifts are synchronous across Britain and Ireland or to predict whether they reflect broader or more regionalised trends.

15.13 Kinds of time and history

So now we have brought together the threads of our narrative, from the analyses presented in the regional chapters, and have attempted, in Ricoeur's terms (1980, 178), to elicit configuration from succession. This has been a study of the causewayed enclosures of southern Britain and their early Neolithic context, but the methodology could have been applied to any other archaeological field lacking either dendrochronology or documentary evidence providing finer chronological resolution than those offered by the scientific methods employed here. So what are the wider implications of what we have tried to achieve?

Timescales

As noted in Chapter 1, the long-term has been the default chronological perspective of many prehistorians. Partly this has been because of our inability to achieve finer chronological resolution routinely, so that in Mike Baillie's striking phrase (1991), all sorts of potentially disparate events and phenomena are 'sucked in and smeared', resulting in a kind of fuzzy prehistory in which the long-term has been seen as the safest, if over-general, option. 'Time perspectivism' is a clear example (see Chapter 1.1). That does not account for all recent discussions of time, in some of which notions like percolating time (Witmore 2007), assemblage (Lucas 2008) and landscape as time materialising (Bender 2002), attempt, at a theoretical level at least, to understand the ways in which things roll on from one moment – or appropriate time interval – to the next. Nor has the short-term been neglected, for example in recent discussions of house durations (Foxhall 2000) and generational or lifecourse cycles (Gilchrist 2000), but tellingly the most detailed studies are from later, quasi-historical periods, as in the analysis of house in classical and Hellenistic Greece (Foxhall 1995; 2000, 492). Even the event has received fresh attention, both as the appropriate scale for 'local, micro-scale, empirical detail…that has emerged as a characteristic of feminist epistemology' (Gilchrist 2000, 325) and as the hinge of structural change (Sewell 2005; Beck *et al*. 2007; Bolender 2010; and see Chapter 1). But while this opening up of more scales is highly welcome, it seems to be still the case for prehistoric studies that, on the one hand, the integration of different timescales is poorly argued and badly understood, and on the other, the long-term maintains its dominant interpretive role. Several examples were noted in Chapter 1. And this is puzzling, since as Robert Paynter has observed (2002, 97), 'the theoretical side of archaeology lost track of time just as the methodological side of archaeology was acquiring the ability to create absolute chronologies'. That comment on late twentieth century practice still seems to hold today.

It is worth briefly going back to the timescales of Braudel, because the notion of *longue durée* and related, general concepts of the long term have been so pervasive and influential in archaeology (Bailey 1981; Robb 2008). But though Braudel sets out his three timescales of *longue durée*, *conjoncture*, and *l'histoire événementielle* to dissect history into 'planes', of geographical time, social time and individual time (1975, 21), it is clear that – however much the general notion of *longue durée* has been picked up by prehistorians – his main interests are in the latter two scales. The scale of the *longue durée* serves in *The Mediterranean* to set the scene, and the significance of geography is always already social and socialised. This was pointed out some time ago by Ricoeur (1984, 209): '…everything he writes about is already part of a history of the Mediterranean…

geohistory is rapidly transformed into geopolitics…global history never ceases to come ashore…'. In one of his earlier papers, Ian Hodder did attack the validity of the long term as a separate plane, independently making many of the same points as Ricoeur; 'each event can be seen, not as the passive by-product of 'the environment', but as an active force in changing that environment (1987, 6). Few prehistorians have noted Ricoeur's critique (but see Borić 2003), and Hodder himself (2006) appears more recently to have inclined to a view of the long-term in the guise of very gradual, barely perceptible and incremental change.

Now this is not to write off a sense of the long-term. There are things that endure and things that change very, very slowly. The universe continues to expand; the earth rotates but gradually wobbles on its axis; ice sheets and glaciers slowly grind rock: all at long timescales hard for us to comprehend as humans, even if we can appreciate them as numbers. Climate may fluctuate over long timescales, though, as say with the end of the Younger Dryas, dramatic change can take place over just a few decades (Severinghaus *et al.* 1998); and population numbers may grow irreversibly but so slowly that any one human generation may be unaware of perceptible shifts, though people often seem to act – and again rapidly – on what they think they perceive as demographic 'pressures', rather than on scientifically measured and tested information (Ardener 1989). Within societies, ritual and styles of art (Bradley 1991, 210) and wider ideational structures (Hodder 1987, 7; 1990), may all also develop over long timescales beyond human consciousness (Giddens 1979, 326; Bourdieu 1990, 53; Gosden 1994, 112). But when this kind of notion of the long-term as slow change is taken to human history, it often seems to say very little. What does it tell us, for example, to state the long-term continuity of agriculture as the principal basis of subsistence from the early Holocene to the present? The statement is true, but very generalised. It would become more interesting if broken down in more detailed stages and trends, and then we could seek to break those down in turn, to examine them at even finer resolution. As Ricoeur has already noted (1984, 224), 'a long time can be a time without any present, and, so, without past or future as well. But then it is no longer a historical time, and the long time-span only leads back from human time to the time of nature'. He goes on (1984, 224):

> If the brief event can act as a screen hiding our consciousness of the time that is not of our making, the long time-span can, likewise, act as a screen hiding the time that we are.

It is worth remembering here the actual scales of Braudel's social and individual times; the latter are more or less self-evident (but see below), while the social time analysed in *The Mediterranean* is confined principally within two centuries, and often to specific decades, or runs of successive decades, within the sixteenth century in particular.

That Ricoeur should comment further (1984, 224) that '*all change enters the field of history as a quasi-event*' (original italics) seems particularly apposite. For him, the 'quasi-event' involves the unfolding of plot and character, and contributes to changes in fortune. Perhaps this leaves an ambiguity about slow, structural changes whose onset was not easily perceptible at any one time; population increase comes to mind as a possible example. But these only become relevant, as observed already for demography (Ardener 1989), when people act in response to real or imagined changes. Ricoeur partly qualified his position by noting (1984, 225) that 'it might perhaps even be said that with the brief event the episodic continues to dominate in plots that are nevertheless extremely complex, and that the long time-span gives precedence to the configuration'. It is hard to give up a notion of the shape of historical change: the 'collective destinies and general trends' of the title of Part Two of *The Mediterranean*. John Robb, for example, has set out (2007; see Chapter 1) his view, as a prehistorian, of the three major social trends in the Neolithic of the Mediterranean and wider areas of Europe, and we offer something of the same below by way of summary for Britain and Ireland. Since we have used Ricoeur extensively as a guide in this discussion, it is fitting to conclude it by one more quotation from *Time and narrative*. He finishes Volume 1 with these words (1984, 225):

> It reminds us that something happens to even the most stable structures. Something happens to them – in particular, they die out. That is why, despite his reticence, Braudel was unable to avoid ending his magnificent work with the description of a death, not, of course, the death of the Mediterranean but of Philip II.

So in our specific study of the early Neolithic in southern Britain and Ireland, we can reflect on the interpretative possibilities raised by the much more precise timescales for change which we have constructed. Both individual constructions and types of things and practices can now be assigned to individual centuries or portions of individual centuries, and even, when archaeology, sample availability and taphonomy, and radiocarbon calibration all combine favourably, to particular decades within individual centuries. Notable gains from this study are more precise timescales for the start of the gradual spread of Neolithic things and practices, beginning in south-east England probably in the 41st century cal BC (Fig. 14.58); its acceleration over much wider areas of western Britain, Ireland, the Isle of Man and Scotland in the late 39th century cal BC (Fig. 14.176); the emergence of monument building as regular practice probably by *c.* 3800 cal BC (Fig. 14.46); the further surge of innovation in the 38th century cal BC (Fig. 14.143); the appearance of enclosure construction in the late 38th century cal BC (Fig. 14.1); and the replacement of enclosures by cursus monuments as the novel style of building enterprise probably from the middle of the 36th century cal BC (Fig. 14.44). After slow beginnings, the tempo of major changes of this kind appears to be brisk, with intervals between major developments from a century and a half to well under a century – from several generations down to two or three. And these were not static horizons, as seen best in the period when most

enclosures were constructed, which again has relatively slow beginnings, then an acceleration in the second and third quarters of the 37th century cal BC, followed by a lull in activity and then a final main burst of fresh building (Fig. 14.20). These 'collective destinies' break down further at the level of the biography of the individual site, which in turn inscribes a history specific not only to time but also to place. For all the activity engaged in enclosure construction across southern Britain as a whole, in any one decade in the second and third quarters of the 37th century cal BC or the first half of the 36th century cal BC there were plenty of areas where things were quiet.

There are of course continuities in the period we have covered. For example, styles of inhabitation of the land and ways of working stone may have had much in common from the fifth into the fourth millennia; the more precise history of early Neolithic pottery styles created by our study still suggests currencies in the order of two to four centuries; and long barrows, long cairns and related monuments were in use, over Britain and Ireland as a whole, from at least the 38th century cal BC to the 34th century cal BC, if not both earlier and later as well. We can also certainly echo John Robb (2007), and many other commentators, in suggesting longer-term trends in the development of the Neolithic, although our new chronologies allow us to trace the processes involved in much greater detail. For example, we have suggested that after the initial establishment of agricultural communities, their social relations became increasingly hierarchical through the middle part of the fourth millennium cal BC. In comparison to the scenario set out by John Robb (2007), our new chronologies bring forward significantly the emergence of more hierarchical social formations and accelerate substantially the pace of their development.

There are also, of course, still plenty of phases whose chronology still lacks the kind of precision we are seeking, such as: the late Mesolithic in Britain and Ireland as a whole; the end of the longhouse world on the adjacent European continent; the rate of spread of continental causewayed enclosures; the development of the first two or three centuries of the early Neolithic in both Britain and Ireland; or the nature and rate of change in the 35th and 34th centuries cal BC in southern Britain. So ours is at best a first step in an emerging narrative.

Lived history

So, perhaps the most important general finding of this project has been the realisation that it is possible to write about a remote past in terms of generations and decades: 'prehistory' is a term we could now abolish. But if enforced reliance on a fuzzy long term, on an inevitable recourse to coarse notions of the *longue durée*, should now be a thing of the past, the questions of links between parts of the narrative plot, of the possibility of multiple narratives, of the unfolding of changes of fortune, and of all the 'retentions and protentions' along the sliding line of time, must be faced by archaeologists concerned with the deep past as much as by historians of more recent periods. What can this study contribute to a sense of how people went on, how their lives unfolded in time (Fig. 15.28), beyond reducing that question to a series of single points in a merely linear chronology?

As ever, others have been here before us. The philosopher Rom Harré, for example, suggested a distinction between biological lifespan (from conception to death), social lifespan (from before birth to after death), and personal lifespan (a period of self-knowledge, from infancy to old age) (1991: see also Sofaer and Sofaer 2008).[13] Paul Ricoeur made his own distinctions (1984; cf. Gosden 1994, 54) between mortal time (which is personal), public time (which is collective), and human time (at the intersection of these other two). And there is of course a much wider and extensive literature on the nature of memory, including the character of social memory (among many others: Connerton 1990; Fentress and Wickham 1992; Forty and Küchler 1999). This has recently been fruitfully drawn upon in Neolithic and other studies, to suggest chains of remembering and forgetting, and varying senses of the past in the past (e.g. Edmonds 1999; Bradley 2002), and the possible link through memory between continental longhouse and insular long barrow or long cairn has already been a favourite of British Neolithic specialists for decades. But this burgeoning literature has tended to trade in generalities, and has not on the whole had the benefit of precise chronologies. Thus Richard Bradley (2002, 8) has asserted, from comparative literature, as already noted, a maximum 200-year span for unaltered oral traditions, which is then applied across the board to a number of Neolithic, Bronze Age and other early situations. Our own study can perhaps now offer useful refinement of these kinds of schema, and relate these to the kinds of chronological resolution now possible. This is important, because kinds and scales of memory are inescapably part of the nexus of structure and agency in which social existence unfolds. Not the least interesting facet of senses of time is their effect on action (Schieffelin 2002; James and Mills 2005).

In this study we have pragmatically used a generalised and heuristic notion of the duration of generations as 25 years. This was based on selected comparative studies (Helgason *et al*. 2003; Slatkin 2004; Whittle *et al*. 2007a). It could well be the case in some situations that generations were reckoned over a shorter timescale, and in many that they were thought of as even longer; one example is that of the grades within the male generation sets of the Borana Oromo, where dominant men operate within a concept of the ideal generation as 40 years, while lesser ones struggle to compete over longer scales (Megerssa and Kassam 2005). Whatever the extent of real variation in reckoning, the generation is a useful measure because on the one hand it fits comfortably within the notion of lifecycle or lifecourse and on the other easily encompasses the notion of event. Again we have no single measure for the span of either average or maximum lifetimes. Life tables for Neolithic Italy suggest average spans of little more than 40 years (Robb 2007, 40) – normally longer than a generation

– with only a very few people aged over 50 in any given small group (cf. Smith and Brickley 2009, 29). But we could also think of maximum lifetimes as say 60–70 years. As already stressed in relation to southern British long barrows (Whittle *et al*. 2007a), a seven-decades lifetime would encompass many of the successions of events and processes shown by the present study. It would not of course cover all changes. Someone born in say 3725 cal BC could have witnessed or heard about the first enclosure construction as a child, participated in further enclosure building as an adult, and lived long enough to transmit to the generation born in the middle part of the 37th century cal BC active memories of how things were done at the beginning. Those descendants could have lived through the lull in activity at the end of the 37th century cal BC, and into the resumption of construction in the first part of the 36th century cal BC. Memory transmitted through two maximum lifetimes – say five to six generations – would be the stuff of social or public time, and one that would be familiar in much later times to historians of say the fifteenth and sixteenth centuries AD (Elton 1974; Braudel 1975). And this seems to fit with the pulses or tempo of change that this volume has regularly revealed in the early Neolithic of southern Britain and Ireland. But why was this? Was there a sense simply of fading time, of inevitably choosing or drifting to do things differently as the visibility, authority and memory of preceding figures dwindled? Or was the early Neolithic sense of time more active in promoting innovation through an ongoing, creative concern for and use of the past? We have argued that long barrows and long cairns, enclosures themselves, and then in turn cursus monuments make varying reference to the past. The traditional position in Neolithic studies has been to look for the longest possible chains of memory, and while that might still apply, with qualification and reservations (because while form may refer to a deep past, internal architectural arrangements and those interred most certainly do not), to the introduction of long barrows and long cairns, it does not accord with our interpretation of the appearance of either enclosures or cursus monuments. Geographical distance – exotic things from far away – can substitute for temporal distance, and creative innovation can replace both.

The past was not confined to the individual lifetime or the span of transmission over a couple of lifetimes. Genealogies on the one hand and myth on the other evoke and often seek to control deeper pasts. The span of lineage reckoning can go back, especially in unilineal systems, a very long way: some 14–17 generations the case of the Tiv of west Africa (Bohannan 1952), and some 34 in the case of the Maori (J.G.D. Clark 1994). Other west African patrilineal systems regularly count 10–12 generations, and there are other examples, such as the Mututsi, who count six to eight generations (J.G.D. Clark 1994, 42–3). This gives a potential span, if generational reckoning were to be, perhaps crudely, turned into linear time, of well over a century to well over two centuries – or even more. In more detail, to take the Tiv case (Whittle 2003, chapter 5), while the general belief was that all the many Tiv were descended from one man, Tiv himself, the normal concern with descent was acted out in the closer setting of the lineage and territorial segment, consisting of some 200–1300 people. In that context, 'three fathers' is the normal range of individual genealogical memory of particular ancestors, beyond which more anonymous ancestors provide a genealogical charter to link back to Tiv himself (Bohannan 1952, 313). Both genealogy and more general ancestry can be seen as charters, to validate present social relationships, which in turn prove the genealogies (Bohannan 1952, 312, 315); the key criterion is consistency. It does not appear to be the case that the bones of forebears were much curated in the early Neolithic (see Chapter 15.10), and the alternative schema of bilateral descent, with often shorter lines traced, was also noted. But there is the potential in this field for one kind of active, if partial, social memory to operate over longer timescales. Counting of forebears, at a certain point, clearly merges into mythical time. The example of the central African Lugbara is a case in point (J. Middleton 1960; Whittle 2003). Mythic time has succession, but little sense of span, and even personal memory is probably often, perhaps normally, selective and creative (Bergson 1911; Bartlett 1932; Bloch 1998; Whittle 2003). Other ethnographies record the richness and variety of chronicles, stories, legends and moral tales that can merge into myth (Turner 1980; Ricoeur 1980), and these can be shown to be a basis for practical action, as among the western Apache (Basso 1984). The possible link between continental longhouses and insular long barrows and cairns comes once more to mind. We can now suggest that the minimum interval between the two was some seven centuries, but it is doubtful if the significance of the link was considered in this way. It is hard, however, to think of any other comparable example of the reach of mythic recall affecting action in the early Neolithic, and this discussion of longer scales of memory serves overall to underline the dominance of much shorter ones.

Total archaeology?

In the quotation which heads this chapter, Lucien Febvre goes on (1935, 35):

> A man who studies the period in which a certain type of Neolithic pottery was widespread is doing history in exactly the same kind of way as a man who draws a map of the distribution of telephones in the Far East in 1948. Both, in the same spirit, for the same ends, are devoting themselves to a study of the manifestations of the inventive genius of mankind, which differ in age and in yield, if you like, but certainly not in ingenuity.

The present study has included several types of pottery, but has gone far beyond those, to bring in, as part of the wider context of causewayed enclosures, a vast array of other activity: life in wooded landscapes; the comings and goings of occupation; pit digging; the keeping and the slaughter of cows; the movement and deposition of stone and flint axeheads; clearance; digging the earth to create enclosures,

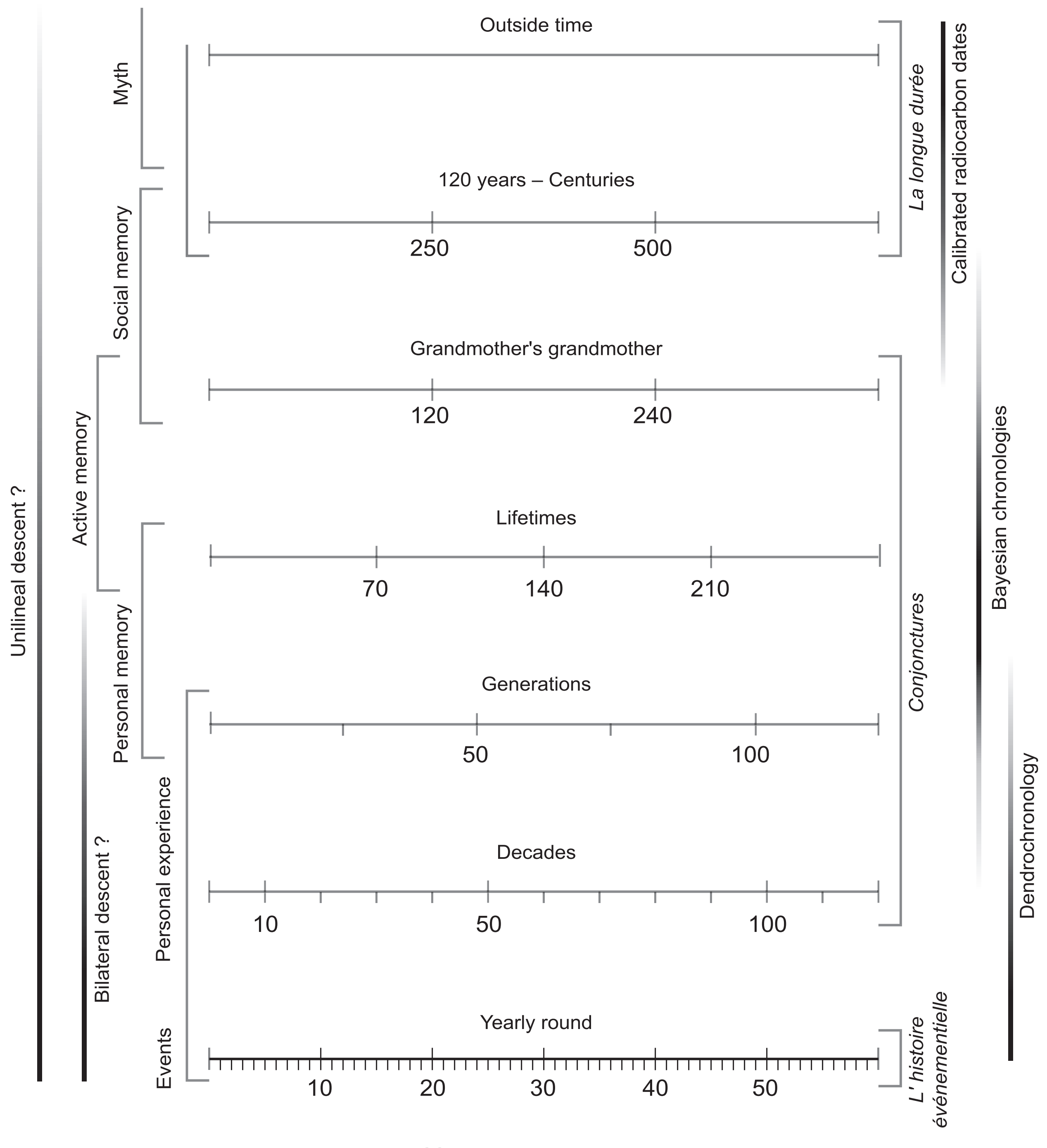


Fig. 15.28. Human timescales, experience and the transmission of memory.

mines and barrows; the building, use and burning of timber houses; the disposal of the dead; ambushes and battles; and assembly and social interaction. We have suggested several dimensions of the socialities through which this history was played out, from families, lineages, alliances and residence groups to wider communities and networks, some of them far afield; the dead are members of this meshwork, but normally as remembered forebears rather than distant or remote ancestors. We have been able to propose, from the finer chronological resolution now open to the discipline, a series of temporalities, with agency and structure playing out principally at the scale of generations, lifetimes and active social memory; the dead had a part at these scales, and occasionally something older comes in perhaps by way of myth and story. We have offered a complicated account, involving both new people and ideas from the outside and indigenous insular people and their existing practices and beliefs, and overall an accelerating tempo of change. We have suggested, within this intensifying sociality, the unfolding of a politics of emulation and competition, though there are no easily applicable or ready-made labels to characterise the diverse situations

and relations encountered. Though there are also many aspects of the early Neolithic in southern Britain and Ireland which require much further research, and which this study has unavoidably investigated without the depth required, especially in the domains of settlement and subsistence, we claim to be offering radically new narratives.

What then should we call this kind of approach? It no longer seems adequate to retain the term 'prehistory', because of its baggage of fuzzy chronology. We have played with the notion of '(pre)history', but while attractive on paper, it is a limp and clumsy distinction when spoken. The French term 'protohistoire' (Daniel 1967) evokes the presence of texts which comment from the outside. Braudel used the term 'total history', designed to 'reconstruct the whole physical, intellectual and moral universe of each preceding generation' (Bintliff 1991, 12), and to catch the never-ending stream of being and events (Hodder 1987, 2), and there has also been talk of 'absolute history' (Paynter 2002, 95). Has the present study then been an exercise in 'total archaeology'? We can aspire to this, but do not claim that we have yet assembled enough detail in our narratives to justify using it. Mindful of Febvre's caution (1973, 35) 'not to underestimate the persistence of that old taboo which says, "You can only do history from texts" ', perhaps we can best conclude by underlining the hope that our kind of study, with narratives taken to the level of lifetimes, generations, decades, and even occasionally events, now begins to take the pre- out of prehistory. But what kind of history? Lucien Febvre saw any definition as a prison (1973, 31). Perhaps we can give the last word to him (1973, 31):

> A definition of history? Which history? I mean at what date and in what framework of civilization? Does history not vary, all the time, in its restless search for new techniques, new points of view, problems needing to be put more aptly? Definitions – do not the most precise definitions, the most carefully thought out and most meticulously phrased definitions run the risk of constantly leaving aside the best part of history?

Notes

1 As this volume was going to press, a marked and rapid increase in population density in Britain coincident with the appearance of cultigens around 6000 cal BP (3950 cal BC) has been claimed on the basis of summing calibrated radiocarbon dates (Collard *et al.* 2010, 267–8 and fig. 1). Further claims about spatio-temporal trends in population density, again based on summed probability distributions, have also been made (Collard *et al.* 2010, 268–9 and fig. 2). We have considerable concerns about the statistical validity of this approach, either for estimating the date of phases of activity in the past (Bayliss *et al.* 2007a, 9–11), or for estimating changes in past population (Surovell and Brantingham 2007), or for spatio-temporal modelling (cf. Buck *et al.* 2002; Nicholls and Nunn submitted). For example, apparent population concentrations in south-central England and southern Scotland in 6100–6000 cal BP (4050–3950 cal BC) appear to be artefacts of the inability of this statistical approach to counteract the scatter on groups of radiocarbon dates (see Chapter 2.2). We are also concerned about the very limited attempts to critically assess the radiocarbon dates included in this analysis (Collard *et al.* 2010, 867), especially as a substantial proportion are likely to include old-wood offsets which will systematically bias the sample towards older ages. In the absence of access to details of the dataset underlying this analysis, it is difficult to disentangle the effects of the statistical methodology employed, the sample of radiocarbon dates available, and the approach to assessing them on the results and conclusions produced.

2 These estimates are based on a complex model combining a total of 71 radiocarbon dates with site-based stratigraphy and archaeological periodisation (summarised in Cassen *et al.* 2009, fig. 11). Twenty-seven radiocarbon dates are associated with the Castellic cultural phase, although only nine of these were certainly made on short-lived material and at least one of these (AA-20403 from the Table des Marchands) appears to be residual, as it is earlier than a series of dates on stratigraphically earlier deposits. Although this model undoubtedly provides the most reliable dating for Castellic pottery available at present, there is certainly potential for refining this chronology. This could be done not only by obtaining further dates on short-lived samples clearly associated with diagnostic cultural material, but also by further investigation of the taphonomy and associations of the existing dated samples, and their potential for including old-wood offsets.

3 'A phenomenon of stylistic unification caused by the interaction of different groups'

4 Dating confirmed by the formal, if rather imprecise, estimate for the first activity in these mines of *4685–4250 cal BC* (*95% probability*; Fig. 5.38: *first NW European flint mines*), probably *4465–4320 cal BC* (*64% probability*) or *4290–4265 cal BC* (*4% probability*), presented in Chapter 5.9.

5 'It could, if the enclosures did not have just a simple defensive function, be to do with signs of emergent tensions in response to scarcer land and a growing population; or, at the least, with the establishment of complex ideological systems whose role was to embody, by a demonstrable rooting in the landscape, communities ever more dispersed in space.'

6 'economy and society evolve towards denser and more hierarchical settlement patterns.'

7 We can also note that, further afield, the situation in southern Scandinavia and the northern European Plain tends to point to the appearance of a new Neolithic ideology following acculturation processes at the Mesolithic–Neolithic transition (Klassen 2004; Müller 2010b). The aquatic resources of the Baltic had enabled internal processes in the Ertebølle culture, ending perhaps in a kind of pot-using, sedentary or semi-sedentary Mesolithic, which took in some domesticates but otherwise did not accept the new traits of southern Neolithic societies.

8 A new German-French project on the Michelsberg culture, 'Die Anfänge sozialer Komplexität: Erdwerke, Rohstoffnutzung und Territorialität im Neolithikum', financed by the Deutsche Forschungsgemeinschaft and the Agence Nationale de la Recherche, has been running since 2010.

9 'Everything happens as if practices just feebly codified in Danubian societies acquired, in the late Neolithic, a much more stereotyped character.'

10 A comparison we owe to Jonathan Last.

11 An idea we owe to Julian Thomas.

12 A suggestion we owe to Lin Foxhall.

Appendix: Some unanswered research questions for southern British enclosures

Frances Healy, Alasdair Whittle and Alex Bayliss

Work on the southern British regional chapters highlighted a number of site-specific questions relating to the enclosures, some of them previously aired, some of them, as far as can be seen, new. Many could be answered by targeted fieldwork. They are noted here, chapter-by-chapter, for ease of reference by those who will concern themselves with these sites in the future. Questions raised for the Isle of Man are included in Chapter 11, and for Ireland in Chapter 12.

North Wiltshire (Chapter 3)

Windmill Hill

Was there a fourth circuit at Windmill Hill? Discussion above (Chapter 15.7–9 and 15.12) suggested that the scale of the outer ditch took people to the limits of what they could conceive in the fourth millennium cal BC. It is worth remembering that there are other earthworks on the north side of the hill, outside the outer ditch, which were considered in the run-up to the 1988 excavations as possible candidates for outworks, perhaps to be compared to those known at other causewayed enclosures (Whittle *et al*. 1999). North-west and north-facing lynchets form an arc, running from the west side of the outer circuit around the north side of the hill, progressively farther away from that circuit until they merge into a linear earthwork which runs south-eastwards away from the site, while one lynchet continues around the hill for some distance to the south (McOmish 1999, fig. 15; Oswald *et al*. 2001, fig. 1.6). They are part of a field system in which vestigial transverse boundaries define small rectangular plots, the morphology suggesting a prehistoric or Romano-British origin (McOmish 1999, 16). Yet the pronounced curve of the terraces around the base of a hill is rare. On Fyfield and Overton Downs to the east and south-east, field systems of Bronze Age and later date are predominantly rectilinear (P. Fowler 2000, figs 2.1, 15.3), as they are on the rest of the Marlborough Downs (Gingell 1992, frontispiece, pls 1, 2, fig. 96). The same is true of the extensively surveyed field systems of Salisbury Plain (Bradley *et al*. 1994, fig. 10; McOmish *et al*. 2002, figs 1.17, 3.4, 3.9). This raises the possibility that the margin of the fields at Windmill Hill could have followed the line of an earlier earthwork. In the event, it was concluded that such earthworks at Windmill Hill were probably part of later field systems (McOmish 1999, 16), but it is worth keeping the question open, should any opportunity arise in the future to test this by excavation.

What were the extent of pit-digging and the character of pit contents within and beyond Windmill Hill? This project has contributed little further information. The intersecting pits outside the Windmill enclosure were not radiocarbon dated (Whittle *et al*. 2000), and this subject is one in need of further research.

What was the nature of later Neolithic and Early Bronze Age activity on Windmill Hill? Interpretations have ranged from appropriation of an already old monument by users of Beaker pottery as a means of legitimising newly acquired power (Bradley 1984, 79–81; Thomas 1999, 43–5, 123–5) to an argument that the monument was the disregarded backdrop to settlement episodes and barrow-building indistinguishable from the overall mosaic of activity across the landscape (Hamilton 1999b). It is difficult to imagine that substantial, well preserved earthworks would have lost all significance, especially within a major monument complex. Re-working of one segment, perhaps accompanied by the creation of a new entrance, around the turn of the fourth and third millennia cal BC and the placing of a burial in that same segment a thousand years later suggest that the enclosure retained a ceremonial role, although undoubtedly a changing and developing one (Whittle *et al*. 1999, 380). There is a good case for interrogating the evidence from these periods in the enclosure in conjunction with that from the flint scatter to the south (Whittle *et al*. 2000).

Knap Hill

Does the discovery of articulated bone in all three of Connah's cuttings through the bank indicate that the entire earthwork is underlain by freshly butchered bone, in turn

indicating large-scale meat consumption very shortly before the enclosure was built?

Rybury

What are the date and function of the spurwork south of the Rybury enclosure (Fig. 3.27)?

South Wessex (Chapter 4)

Hambledon Hill

What was the nature and extent of earlier Neolithic activity over the unexcavated parts of the Hill, especially outside and between the enclosures?

Was there a further, outer, outwork on the Shroton spur?

Can the relation between the Stepleton and Hanford earthworks be better-defined? Investigation in and either side of the area where the outworks swing across the contours could clarify this.

What was the extent of Neolithic earthworks on the hillfort spur? The Iron Age ramparts may conceal even more extensive Neolithic earthworks than have been identified. The location of Neolithic entrances on the gentle slopes of the Shroton, Stepleton and Hanford spurs suggests that there may be another at the south-east angle of the hillfort spur.

Can environmental evidence from the hill itself be enhanced, at least to match advances in Cranborne Chase? If the technical difficulties could be overcome, a section at a location where a Neolithic earthwork is known to underlie Iron Age ones could yield sealed soils of both dates, as well as the potential for taking stratified sequences of mollusc samples through two sets of ditch fills.

Can the character, landuse history, and chronology of the apparent concentration of Neolithic settlement on the coastal plain to the south be elucidated? There is also the still untapped potential of the unpublished excavation of numerous pits, some with Bowl pottery in the South-Western style, at Moortown, on the lower Stour (Horsey and Jarvis 1984).

Can the prehistory of the Blackmoor Vale to the west of Hambledon Hill be elucidated? The area remains an archaeological and palaeoenvironmental blank, and with that blank persistent, understanding of the local human presence is one-sided. Its fluviatile deposits could provide a history of its human use, and might encapsulate stratified archaeological material. The Vale of Melksham stands in the same relation to Windmill Hill.

Whitesheet Hill

What is the date and function of the cross-ridge dykes and second enclosure, not to mention the enclosure preceding the hillfort (Fig. 4.22)?

Maiden Castle

How many Neolithic ditches are there at Maiden Castle?

What became of the spoil from the inner enclosure ditch? The chalk excavated from the outer enclosure ditch is likely to have been backfilled into it. The chalk excavated from the inner ditch has disappeared, and, at least in Trench I, it had done so by the time the long mound was built. Despite the restricted size of the trenches, and the presence of Iron Age features on and near the inner lip of the ditch, there are places where any surviving bank would have been visible (Sharples 1991a, figs 46–47). But there are no traces of any bank. One possibility is that the construction of the long mound over the circuits was accompanied by the obliteration of the above-ground earthwork and the incorporation of its mass into the long mound.

Was the Maiden Castle long mound built in stages, and was its central part a long barrow?

How did the one remaining apparently Neolithic burial in the area of the east end of the Maiden Castle long mound (skeletons Q2 and Q3) fit into the sequence?

How much use and re-working of Maiden Castle was there in the third and second millennia? Some features potentially of this age could not be tested in the course of the 1985–6 excavations or this project. In Wheeler's trench G, in the east hillfort entrance, a dense scatter of Beaker sherds (Wheeler 1943, 156, pl. XXIIIb) in the top of the inner enclosure ditch (Wheeler 1943, pl. XI: layer1) was associated with the fragmentary remains of two children (Skeletons GM1(a) and (b); Morant and Goodman 1943, 343–4), which, if they were not redeposited from Neolithic contexts, may suggest ceremonial use rather than occupation (Cleal 1991, 185). Sharples points out, too, that palisades in front of the original east hillfort entrance (Wheeler 1943, pl. CXIX: 'early palisades') were stratigraphically unrelated to the primary hillfort and may conceivably connect to activity of this period (1991a, 60).

Robin Hood's Ball

What is the date of the outer circuit at Robin Hood's Ball?

How did activity outside Robin Hood's Ball relate to the use of the enclosure?

Other sites

What was the date and nature of activity at Scratchbury?
What was the date and nature of activity at South Cadbury and Ham Hill?

Sussex (Chapter 5)

Whitehawk

Does the external bank of ditch 2 incorporate a pre-existing long barrow? One of the segments excavated by Ross Williamson seems to change course around a conspicuous part of that bank: 'Curwen shows a length of bank to the north of this, adjacent to the ditch excavated in 1929. This is the only part of the second bank noted by him, so

it must have been more prominent than the rest. Indeed, it is depicted on both plans as a long mound, measuring *c.* 16 m long and 9.5 m wide, and it is conceivable that it was an earlier feature incorporated into the bank and ditch' (RCHME 1995a, 17).

What are the date and stratigraphic relationships of enclosures 2a and 3a, identified by RCHME in 1993? Were they originally complete circuits, subsequently reworked into and partly overlain by later ones?

What are the date and stratigraphic relationships of the north-east tangential ditch?

Are there yet further circuits, perhaps corresponding to the fifth and sixth ditches observed by Curwen?

What is the date of the north-south row of pits or ditch segments on the racecourse to the south of the circuits, and does it relate to the complex?

The Trundle

Can The Trundle be more effectively dated?

How many circuits are there? How complete are they? How do they relate to each other?

Are the postholes surrounding segments of the second ditch and perhaps spiral ditch 2 contemporary with the segments or of Iron Age date, as suggested by Piggott (1954, 27)?

What was the Neolithic use of the areas within and between the ditches?

How many of the earthworks on the spurs to the west and north of The Trundle are part of the Neolithic complex rather than the Iron Age one?

Halnaker Hill

What is the date of Halnaker Hill?

Eastern England (Chapter 6)

The lower Nene and Welland

Why is there a cluster of causewayed enclosures here and how did its components relate to each other?

Uneven monument distribution

Is the apparent scarcity of Neolithic monuments east of the fens real or illusory? Could it be due to, for example, the presence of non-classic forms such as the Godmanchester trapezoid enclosure on the Great Ouse or some of the smaller monuments in the Nene valley?

What is the record of less fully investigated areas like most of Suffolk, the Coverloam of north-east Norfolk or the area north of the Welland?

Pit sites

Can adequate dating of extensive pit sites establish for how long they were used?

Can any chronological dichotomy be detected between extensive pit clusters and isolated pits and ephemeral contexts containing early Neolithic material? More extensive dating of features of both kinds at Barleycroft Farm, where different kinds of Bowl occur in different kinds of context, might be productive, as might dating of contexts with potentially early pottery, such as the hollow at the John Innes Centre.

The Greater Thames Estuary (Chapter 7)

St Osyth

Can the full plan of the St Osyth enclosure be established? Can more of the ditches be excavated and more datable samples obtained from ditch contexts?

Orsett

Can more be excavated of all parts of the enclosure to provide more datable samples from all three ditch circuits, the palisade and entrance features, and interior features?

Can other early Neolithic occupation sites in the vicinity be more precisely dated?

What was the date of the Springfield causewayed enclosure, the nearest neighbour to Orsett?

Kingsborough

Since more datable material exists from Kingsborough 1, but was not available at the time of sampling for this programme, can this be dated?

Burham

What was the date of the causewayed enclosure at Burham in the Medway valley, and how does it relate to the stone and timber constructions there?

Chalk Hill

Can any more of the inner, middle and tangential ditches be investigated to provide datable material for those circuits?

Does the large and elongated Nethercourt Farm feature nearby suggest the presence of *another* enclosure? Are the Kingsborough sites the only immediate neighbours around the Thames estuary?

Beyond the enclosures

Can other parts of Kent be further investigated? What of the Downs above Folkestone? What of the few known or suspected long barrows? What of the probable enclosure at Eastry? Are there really no cursus or other linear monuments in Kent?

Can more occupations be dated from both Essex and Kent? Can contexts sealed beneath or in alluvium, peat

and brickearth be further exploited? Can the cropmark long barrows/long enclosures in both Essex and Kent be confirmed as Neolithic monuments?

The Thames Valley (Chapter 8)

Enclosures

What are the date and character of the ten known or probable causewayed enclosures in the middle and upper Thames which are so far uninvestigated?

Can Blewburton Hill above the valley be confirmed as a causewayed enclosure?

Has aerial survey been sufficiently extensive for all enclosures in the valley and along its sides to have been recognised? Can other forms of prospection be applied, including ones to sense remotely beneath alluvium?

Can anything further now be retrieved from Abingdon?

Can more be discovered of the character of Eton Wick and Gatehampton Farm?

Beyond the enclosures

Can concentrations of fifth millennium cal BC activity be located, for example along the palaeochannels of the middle Thames around Eton and Dorney?

What is the absolute date and character of the earliest Neolithic deposits at Runnymede?

Can the sequence of middens at Eton Rowing Lake be dated with greater precision?

More generally, can the potential of surfaces preserved beneath alluvium, unrivalled perhaps in any other area covered by this volume, be linked to further investigations of valley enclosures?

What is the detailed sequence of mortuary structures other than long barrows in the valley? Can we extend our understanding of valley-upland relationships?

Can we obtain more information on the transport of Chalk flint into the upper valley (already noted by Leeds in the 1920s) and the Cotswolds?

Can we obtain more precise dates for more cursus monuments in the Thames valley?

The Cotswolds (Chapter 9)

Crickley Hill

What was the nature and extent of fifth millennium cal BC activity here?

Can the chronology of the internal structures be elucidated?

What are the chronology and functions of the platform and shrine, the earlier stages of the long mound and the stone circle?

Peak Camp

Is there an inner earthwork and what is its date?

What are the nature and functions of the Area II ditch?

What other features lie in the interior?

Long barrows and cairns

What are the dates of The Crippets, Coberley and Briery long barrows, close to Crickley and Peak Camp? More broadly, can the existing archive for long cairns and barrows in the Cotswolds be further exploited to strengthen the chronologies outlined here?

The South-West (Chapter 10)

Enclosures

Can more be found of the enclosure at Membury?

Can more of the outer ditch be traced at Hembury? Can the features found between the Neolithic earthworks be further elucidated?

Can more of the circuits at Raddon be excavated?

Can the outer enclosures at both Helman Tor and Carn Brea be shown without question to belong to the same date as the tor enclosures?

There are various possible enclosures in the region, noted in the chapter, which need confirmation. And can anything still be done with what remains of High Peak?

Beyond the enclosures

What is the chronological relationship of causewayed enclosures and tor enclosures in the south-west to portal dolmens, long barrows, the Broadsands chambered monument, long 'mortuary' enclosures, entrance graves and cursus monuments?

The Marches, south Wales and the Isle of Man (Chapter 11)

Enclosures

How many of the Welsh causewayed enclosures are Neolithic? While the early Neolithic dates of the Banc Du and Womaston causewayed enclosures have been confirmed, the age of Norton remains uncertain following evaluation. This, and the first millennium cal BC date of Beech Court Farm, Ewenny, increase the desirability of obtaining secure dating for the possibly Neolithic causewayed enclosures at Corntown and Flemingston in south-east Wales and at Woolston in Shropshire. Dorstone Hill, in Herefordshire, would benefit from systematic analysis of the records and finds from the excavations of some time ago.

Beyond the enclosures

Is the Neolithic archaeology of Trostrey Castle, Monmouth-

shire, even half as significant as the interim statements tantalisingly suggest? This merits analysis and publication, with more effective dating, even if the entire story is only half as dramatic as the provisional accounts of monumental timber structures and other features indicate.

Can the dating of portal dolmens and related structures be improved, at least to the level of that of long barrows and cairns? Their age floats between typologically-based assertions of a very early fourth millennium cal BC date and the mid-fourth millennium *terminus post quem* for Carreg Coetan proposed in Chapter 11. Analysis and publication of Carreg Coetan would itself be an important gain, and might conceivably be accompanied by better dating, if the collection affords suitable samples. The inherent difficulty of finding such samples from monuments which could have remained accessible over long periods is, however, a problem here and elsewhere in Atlantic Britain.

Can settlement evidence, including that of lithic scatters, be analysed systematically and related to the monuments? While Banc Du is placed in its local context by the SPACES project, analysis of settlement evidence remains scant elsewhere, although that evidence is itself locally abundant.

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